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Veterinary Medicine

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features in this issue...

Studies on Leptospirosis: VI Vaccination of Swine with Leptospirosis pomona Bacterin

Practical Application of Serological Tests for Leptospirosis

The Veterinarian in Public Health

Orela Administration of Anthelmintics for Control of Cattle Grubs

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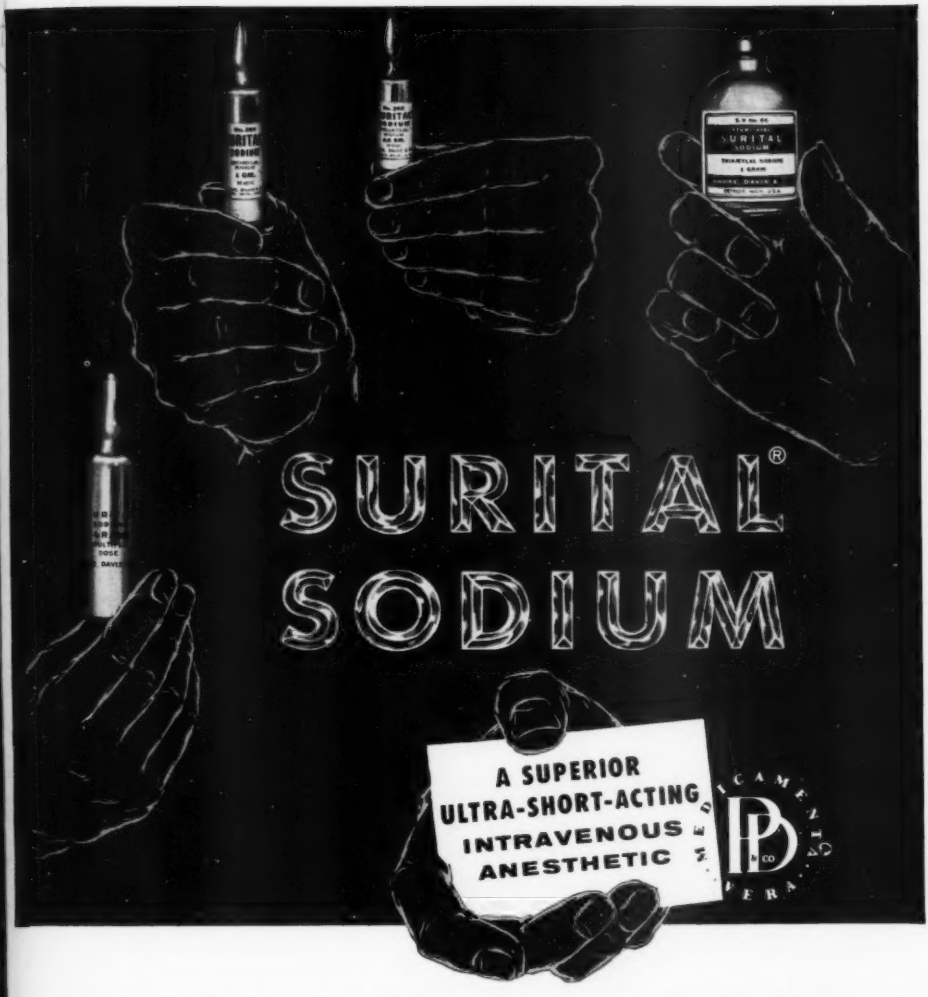

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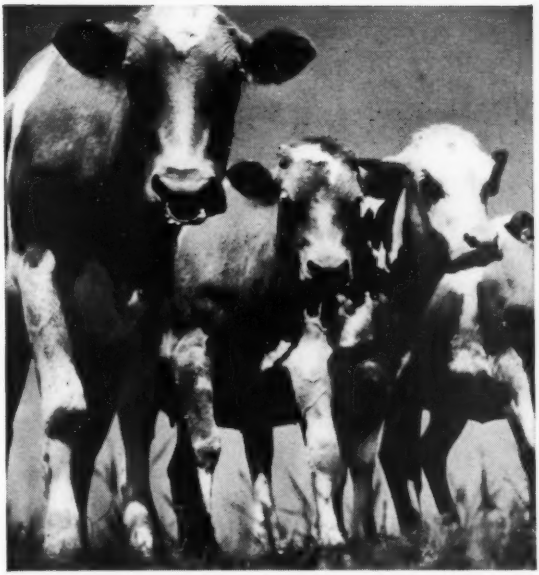

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The Growing Problem of Leptospirosis

Leptospirosis is not a new disease. A disease of man characterized by fever, jaundice, and hemorrhage was observed over a century and a half ago. In 1886, Weil, for whom the disease was named, described differentiating characteristics and in 1914 Inada and Ito identified the cause to be a Leptospira. A similar disease of dogs was described by Hofer in 1850 which became epidemic in Germany in 1898, where it was first called Stuttgart disease.

Research workers have subsequently added to accumulated information regarding this pathogen but the infection did not attract much attention until it was shown to have specific etiology, and to exist in rodents, pets, and domestic animals in addition to man. In 1937, Meyer and associates reported Weil's disease in a veterinarian and stated that "Since it is now proven that, in certain areas of California, as many as 34% of the dog population is subclinically infected with Leptospira canicola, urinary shedders are doubtless quite common." The first detailed report conclusively establishing existence of canine leptospirosis in the United States was subsequently published by Meyer et al (Jour. Am. Vet. Med. Assn., 48:710 [Dec.], 1939), less than 20 years ago. That the disease was an occupational hazard for veterinarians was emphasized.

More recently, leptospirosis has been demonstrated to be an important disease of pet animals, the third most serious disease of cattle, and a major disease problem of swine. It is a matter of conjecture whether present incidence has increased alarmingly or whether diagnostic methods have so far improved as to make possible differentiation.

In any event leptospirosis poses a problem of growing concern to veterinarians. Beside its being a serious public health menace, losses caused due to abortion in cattle and swine, and retarding influences on growth, milk production, and gain is estimated to exceed $100,000,000 annually in the United States (see Losses in Agriculture).

The problem of leptospirosis is being defined. Control efforts can now be instituted with assurance of favorable results. If employed intelligently, practices based on species susceptibility, means of spread, improved methods of diagnosis, and use of prophylactic agents, might be expected to minimize losses.

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St. Petersburg 4, Fla.

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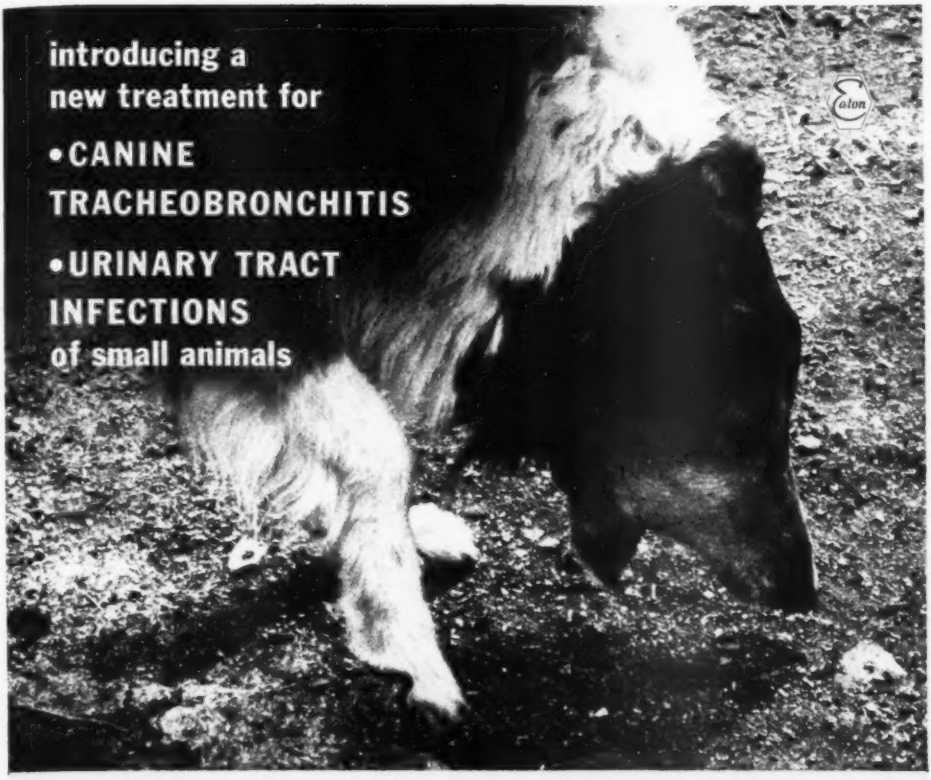

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1. Mosier, J. E.: Vet. M. 50:605, 1955. 2. Breakey, R. S.; Holt, S. H., and Siegel, D.: J. Michigan M. Soc. 54:805, 1955.

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REFERENCES: 1. Segard, C.P.: Farmer's Digest, May, 1955. 2. Henry, R. T., and Blackburn, E. G.: Vet. Med., In press. 3. Bull, W. S.: N. Amer. Vet., In press.

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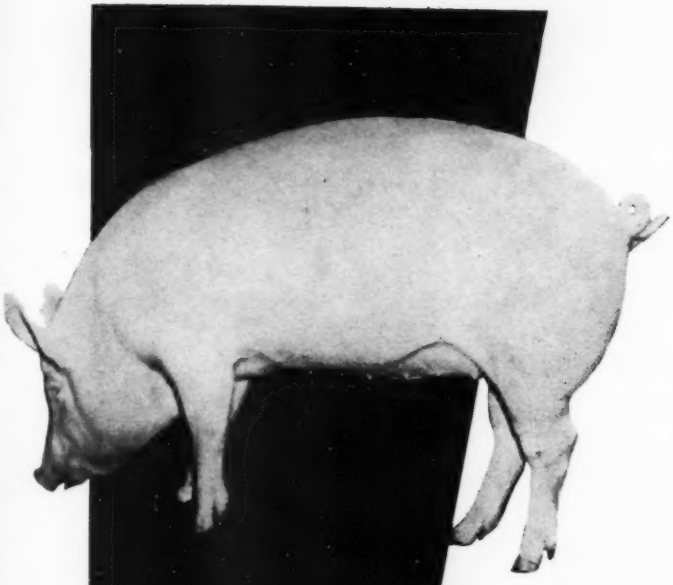

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*Jones, S. V.; Belloff, G. B., and Roberts, H. D. B.: Vet. Med. 51:413 (Sept.) 1956.

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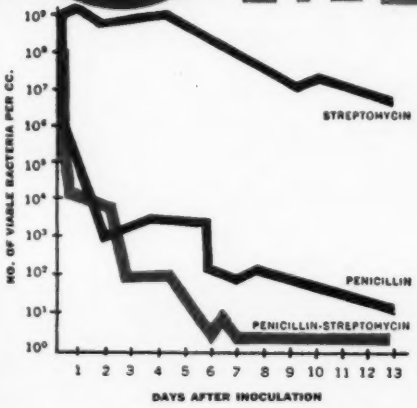

This graph presents the combined, synergistic antibacterial action of penicillin and streptomycin on a culture of *Streptococcus liquefaciens* (strain L. W.).[2]

1. Welch, H.: Antibiotic Med. & Clin. Therapy *3*:375 (Nov.) 1956. 2. Adapted from Hunter, T. H.: J.A.M.A. *144*:524 (Oct. 14) 1950.

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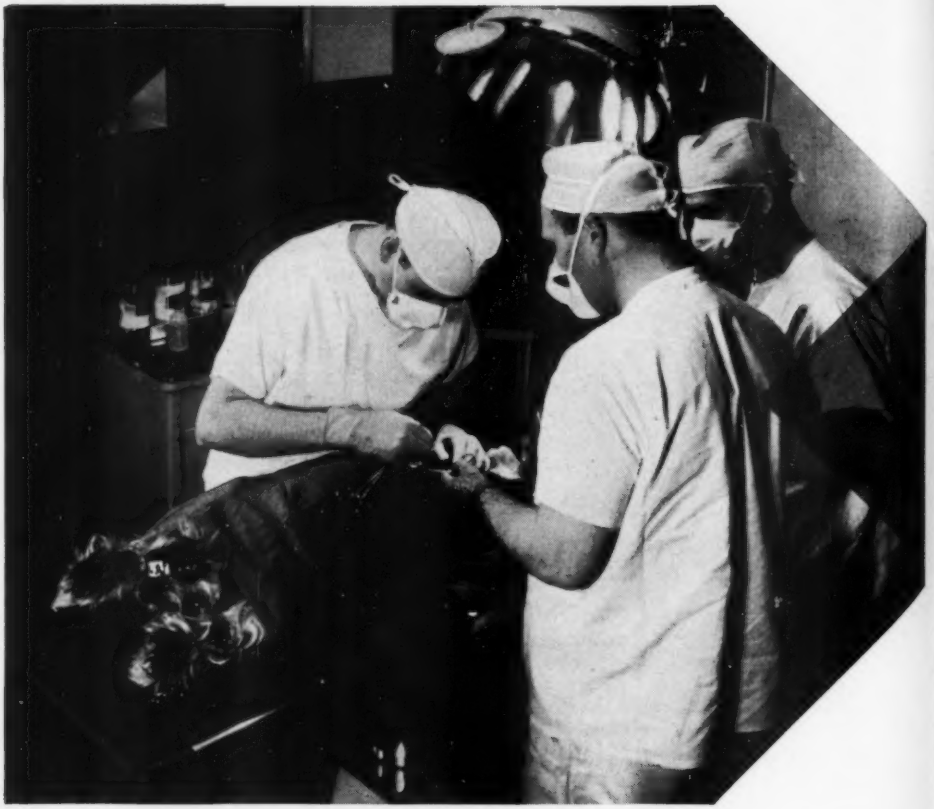

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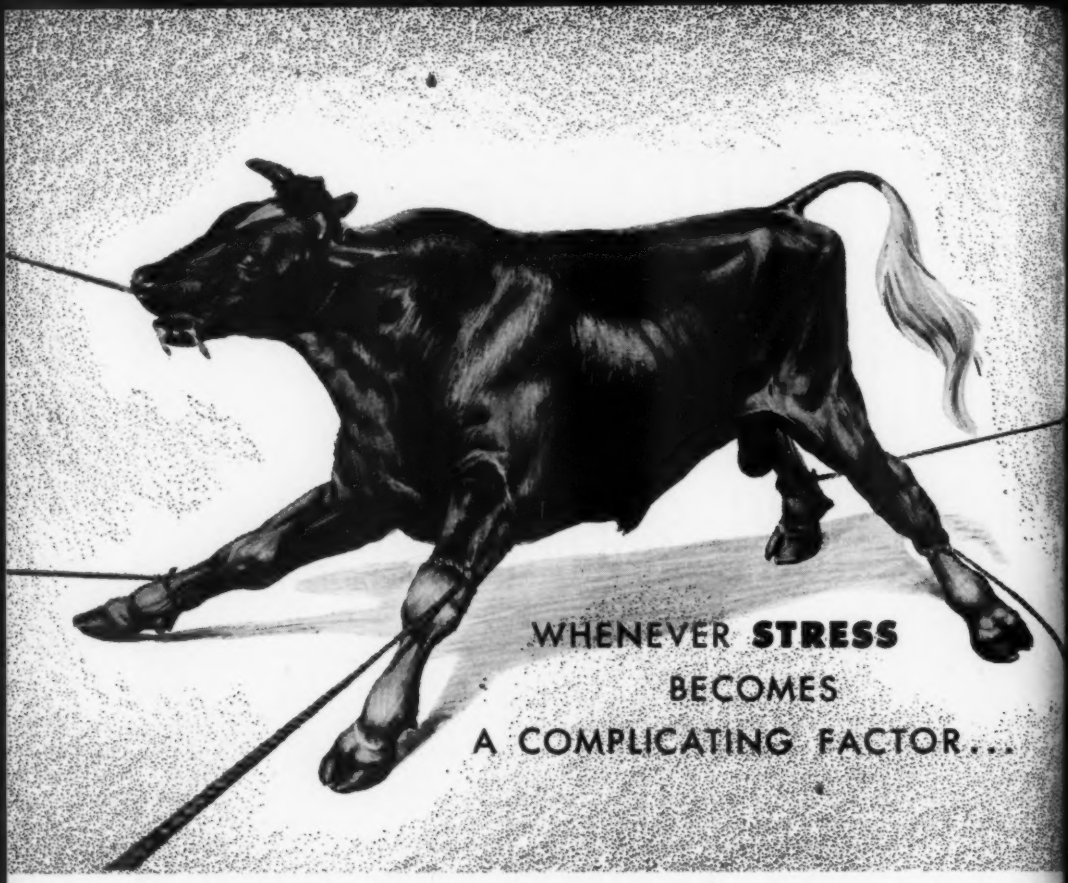

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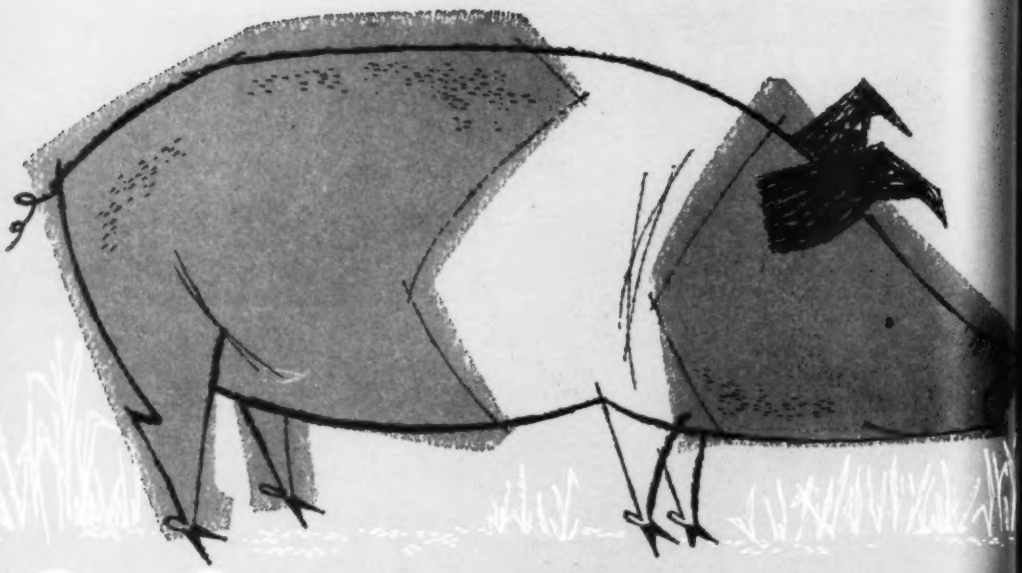

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Studies on Leptospirosis in Domestic Animals. VI: Vaccination of Swine with *Leptospira pomona* Bacterin†

H. S. BRYAN,* D.V.M., Ph.D., Urbana, Illinois

ABORTION is a most serious problem in outbreaks of swine leptospirosis. Veterinarians report that symptoms of abortion appear in about 85% of swine herds that become infected.[1] To the farmer this means frequently the loss of an entire pig crop as sows and gilts farrow dead or weak pigs.

Leptospira pomona, the causative agent, has been isolated from aborted swine fetuses in Illinois.[2] Since isolation of Leptospira is not easily accomplished, serological tests are usually relied upon for diagnosis. The results of an Illinois serological survey indicates that up to 29% of the swine herds may be infected.[1]

In an attempt to find a solution for the abortion problem which is associated with porcine leptospirosis, two *L. pomona* bacterins were studied. This paper describes the experimental evaluation of the bacterins in an active immunization program.

Materials and Methods

Thirty young, unbred, Hampshire gilts with an average weight of about 140 lb. each, were purchased from a single, leptospirosis-free herd. They were blood tested and found negative for brucellosis and leptospirosis prior to their purchase and again upon arrival at destination. They were maintained as a single herd at the University of Illinois Veterinary Research Farm for the duration of the experiment. Pasture was provided to the time of challenge. Three weeks prior to breeding, gilts were identified by both ear tag and ear notch and subsequently vaccinated. They were pasture bred by three young, leptospirosis-free, Spotted Poland-China boars during a four-week breeding period. Six weeks after the boars had been removed, the gilts were moved to the main barn at the Veterinary Research Farm for exposure to a virulent culture of *L. pomona* strain S80205. They were continuously maintained as a single herd until farrowing time, at which time individual pens were provided.

For the experiment, the gilts were divided into three groups of ten animals each and treated as follows: Group I gilts (1 through 10) were vaccinated with 5 ml. of a *L. pomona* bacterin designated antilepto.® Gilts 1 through 5 were injected subcutaneously into the right axillary space and gilts 6 through 10 intramuscularly in the right rear gluteal region.

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†From the Department of Veterinary Pathology and Hygiene, College of Veterinary Medicine, and the Agriculture Experiment Station, University of Illinois.

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The author gratefully acknowledges the technical assistance of Rachel Marlowe, Robert Goodin and Leroy Biehl.

*Present address, The Upjohn Company, Kalamazoo, Mich.

®Antilepto, *Leptospira pomona* bacterin prepared by the Biological Production Laboratories, Merck Sharp and Dohme Division, West Point, Pa.

Group II gilts (11 through 20) were vaccinated with 5 ml. of experimental *L. pomona* bacterin, designated as P54874. Gilts 11 through 15 received the bacterin subcutaneously in the right axillary space and gilts 16 through 20 intramuscularly in the right rear gluteal region.

Group III gilts (21 through 30) were not vaccinated and served as unvaccinated controls (tables 1, 2 and 3).

The commercial *L. pomona* bacterin[2,4] employed in this study was supplied from a current production lot. The experimental bacterin designated as P54874 was prepared from *L. pomona* strain P54874 which had been isolated at the University of Illinois from an aborted swine fetus.

Leptospirosis blood test[1] used in this study was the serum agglutination-lysis test, using viable organisms as the antigen. For routine testing, four serum dilutions were employed: 1:10, 1:100, 1:000, and 1:10,000. The end titer was determined on each serum designated as positive in the 1:10,000 dilution. Leptospirosis blood tests were made on each gilt at weekly intervals as follows: Preceding vaccination, following vaccination and after exposure to virulent *L. pomona*. A total of 24 consecutive weekly bleedings was made; three during the prevaccination period, 12 during the postvaccination period, and nine following exposure.

Three months after vaccination, during the calculated mid-gestation period, animals were challenged with known virulent *L. pomona* strain S80205. The challenge inoculum consisted of a mixture of defibrinated, guinea pig blood and liquid culture of *L. pomona* strain S80205 in equal parts. The guinea pig blood was secured from three guinea pigs which had been infected artificially with strain S80205 and which were at the height of fever when bled. The liquid culture consisted of pooled, seven-day-old motile cultures of strain S80205 grown in modified Stuart's medium containing 10% horse serum. The 0.1 ml. infecting dose of the inoculum was equally divided so that 0.05 ml. was instilled into each conjunctival sac. The inoculum was administered with a tuberculin syringe. The operator pulled the lower eyelid away from the eyeball with one hand and introducd the inoculum from the syringe with the other hand. After each inoculation the eyelid was closed and the eye massaged lightly. Precautions were taken so that operator and animal handlers would not become infected.

Daily rectal temperatures were taken immediately preceding and for three weeks after challenge. A two degree or higher Fahrenheit rise in body temperature was recorded as indicative of fever.

Urine samples were collected from each gilt during the postchallenge period for direct darkfield microscopic examination and for guinea pig inoculation. Urine collections were made by following the gilts with long-handled dippers in hand. Early afternoon, after the gilts had been lying down for a time, was found to the best time to collect urine as the gilts usually urinated as soon as they were made to rise. After collection, samples were placed in a large sterile test tube and immediately examined microscopically in a laboratory maintained within the holding unit. At the same time, a laboratory assistant injected 2 ml. of each urine specimen intraperitoneally into a young guinea pig. The microscopic examinations and guinea pig injections were made at weekly intervals, postchallenge, for six consecutive weeks.

A urine specimen was considered positive on direct microscopic examination when one or more motile leptospires were observed; otherwise, it was considered negative.

Guinea pigs inoculated with urine were bled four weeks after injection. Blood was subjected to the agglutination-lysis test. A guinea pig was considered infected (positive) when it had a titer of 1:100 or higher; otherwise, it was considered uninfected (negative).

The gestation outcome of each gilt was recorded. At birth, the baby pigs were classified into one of the following categories: Good, dead, or weak. It was not difficult to identify the good pigs and the dead-at-birth pigs. However, baby pigs placed in the "weak" category ranged in vitality from those that survived but a few hours to those that remained noticeably weak for up to 48 hours after birth. If there was more than one dead or weak pig in the litter at birth, gestation outcome was considered abnormal. Non-pregnant gilts were readily determined in two of the three such animals as they demonstrated heat periods during the postchallenge period. The third gilt was killed to establish non-pregnant status.

Results

Specific *L. pomona* antibodies appeared in the blood serum in nine of the ten gilts vaccinated with the commercial bacterin (group I). In five of these, titers remained below the 1:100 level. In the remaining five titers reached a

1:100 or higher level; one developed a 1:-10,000 peak. The average peak titer for group I was 1:1,044 and average duration of the postvaccination titers was 5.7 weeks.

Each gilt in group II that received the experimental P54874 bacterin developed a titer of 1:100 or higher following vaccination. The average peak titer was 1:2,440, and the average duration of the titers was 8.4 weeks.

The gilts in group III were unvaccinated; they did not develop specific *L. pomona* antibodies during the postvaccination period (table 1).

At challenge time, 12 weeks after vaccination, two animals in group I still had titers of 1:10 and 1:100 and three in group II had retained titers of 1:10, 1:100 and 1:100 respectively.

The average postchallenge peak titer for the group I gilts was 1:3,412, for group II 1:11,-134 and for group III 1:550,000 (table 1). The average postchallenge peak titers that developed in the vaccinated animals (group I and II) exceeded but slightly the average peak postvaccination titers. This indicated lack of infection. In comparison, unvaccinated animals developed high titers during the postchallenge period which indicated infection.

Postexposure infection was measured also by gestation outcome; normal litters indicated lack of infection in gilts and abnormal litters indicated infection. Of the 30 gilts in the experiment, all became pregnant except three in the control (group III) group. The outcome of gestations was recorded as follows: Group I, ten pregnant gilts, all farrowed normal litters;

TABLE 1. Leptospirosis Vaccination in Gilts; Postvaccination and Postchallenge Titers*

Gilt No.	Prevaccination	Titer of Serum Samples Postvaccination Peak	Challenge Time	Postchallenge Peak
		Group I Antilepto		
1	0	100 (5)**	0	1,000
2	0	10 (6)	0	1,000
3	0	10 (6)	0	1,000
4	0	100 (5)	0	10,000
5	0	10,000 (12+)	100	1,000
6	0	100 (10)	10	100
7	0	10 (5)	0	10
8	0	100 (7)	0	10
9	0	10 (1)	0	10,000
10	0	0	0	10,000
Ave.	0	1,044 (5.7)	11	3,412
		Group II P54874 Bacterin		
11	0	1,000 (7)	0	10
12	0	100 (7)	0	100
13	0	10,000 (12+)	100	100,000
14	0	1,000 (7)	0	10,000
15	0	1,000 (6)	0	10
16	0	100 (7)	0	1,000
17	0	100 (9)	0	10
18	0	1,000 (11)	10	10
19	0	10,000 (12+)	100	100
20	0	100 (6)	0	100
Ave.	0	2,440 (8.4)	21	11,134
		Group III Unvaccinated Controls		
21	0	0	0	100,000
22	0	0	0	1,000,000
23	0	0	0	1,000,000
24	0	0	0	1,000,000
25	0	0	0	100,000
26	0	0	0	100,000
27	0	0	0	100,000
28	0	0	0	1,000,000
29	0	0	0	1,000,000
30	0	0	0	100,000
Ave.	0	0	0	550,000

*Agglutination-lysis titers expressed as reciprocals.
**The figures in parentheses show the duration of the titer in weeks; 12+ indicates retained titer of over 12-weeks' duration.

group II, ten pregnant gilts, all farrowed normal litters; group III, seven pregnant gilts, three farrowed normal litters and four aborted or farrowed abnormal litters (table 2).

Gilts in group I farrowed a total of 89 baby pigs (8.9 average per litter) of which 88 (98.9%) were classified as good pigs and 1 (1.1%) was weak. Group II gilts farrowed 71 baby pigs (7.1 average per litter) of which 68 (95.7%) were classified as good pigs; three (4.3%) were dead at birth. The seven pregnant gilts in group III farrowed a total of 55 baby pigs (7.8 average per litter) of which 27 (49.1%) were good, 21 (38.2%) were dead, and 7 (12.7%) were weak at birth (table 3).

Postchallenge leptospiruria was measured by direct microscopic examination of urine and by injection of urine into guinea pigs. On the microscopic examination of urine, all gilts in group I and II remained negative whereas six (60%) of the ten gilts in group III became positive. In those that became positive, none was positive the first week after exposure, one was positive the second week, three were positive the third week, and six were positive on the fourth week. The number of times that each was positive varied from one to five times (table 2).

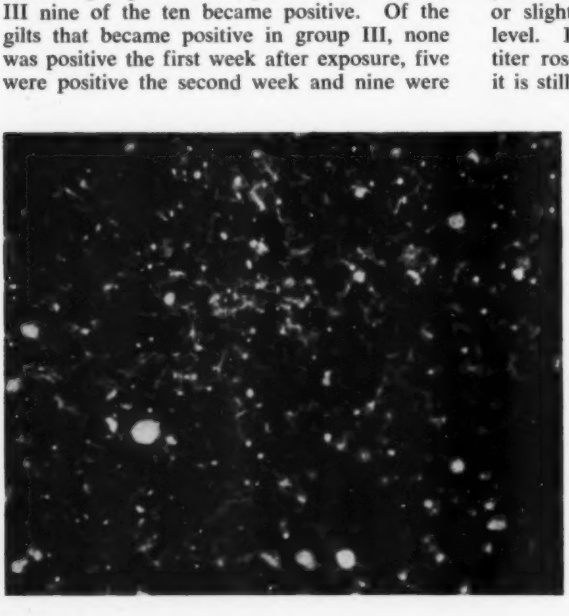
Leptospiruria occurred, as judged by guinea pig inoculation, as follows: Four of the ten group I gilts became positive (three were positive one time only and one was positive twice), none of group II became positive but in group III nine of the ten became positive. Of the gilts that became positive in group III, none was positive the first week after exposure, five were positive the second week and nine were positive on the third week. The number of times that each was positive varied from one to five times (table 2).

Postchallenge fever was not detected in any of the vaccinated group I and group II gilts, but three of the ten unvaccinated controls in group III demonstrated a brief febrile reaction.

Discussion

In evaluating the protection engendered by *L. pomona* bacterins under test, several criteria were used, *i.e.*, postchallenge titer rise, gestation outcome, leptospiruria, and fever. Of these, gestation outcome was of most concern inasmuch as the desire to protect gilts against abortion was the main reason for the experiment.

Based upon postchallenge titer rise, infection occurred in 100% of the unvaccinated controls and in none of the vaccinated animals. Thus, both bacterins appeared to stimulate complete protection of the vaccinated gilts to challenge infection. An explanation for this circumstance would seem appropriate. It was concluded that active infection resulted among the control gilts in this experiment as high titers (1:100,000 and higher) developed after exposure. In vaccinated gilts, titer rise is not a fully dependable indicator of whether or not infection occurred inasmuch as an apparent anamnestic response to the exposure culture results. In the vaccinated animals, postexposure titers of most individuals approached or slightly exceeded the postvaccination titer level. In one case, gilt 13, the postexposure titer rose to 1:100,000 (table 1). However, it is still difficult to believe that this high titer



Negative agglutination-lysis test reaction as viewed through the microscope. The leptospires remain uniformly spread throughout the field.

was due to an active infection when a titer of 1:10,000 had occurred following vaccination and when at the time of challenge exposure it was still 1:100. It was believed that active infection did not result in the vaccinated gilts because the postexposure titers did not greatly exceed the postvaccination titers.

Based upon abnormal litters, infection was established in 57.1% of the unvaccinated controls but in none of the vaccinated gilts. Using this criterion, both bacterins appeared to stimulate complete protection of the vaccinated gilts to the challenge infection.

Based upon the development of leptospiruria, nine of the ten unvaccinated controls, four of the ten which received the commercial bacterin, and none of the gilts which received experimental bacterin became infected. Leptospiruria was determined by combining the results of the direct microscopic examination of urine and the inoculation of guinea pigs with urine. By this yardstick of protection, all of the gilts which received the experimental bacterin and a majority of the gilts which received the commercial bacterin were rendered refractory to infection. In the latter group brief transitory leptospiruria developed in four gilts (table 2).

Based upon temperature rise, it would appear that clinical manifestations of infection occurred in three of the ten unvaccinated controls. In comparison, none of the vaccinated animals developed fever which might be taken to indicate complete protection. Since clinical manifestations, other than abortion, rarely occur in swine leptospirosis it must be stated that this criterion for measuring postchallenge infection is inadequate. Actually, none of the gilts in this experiment showed any visible or physical signs of illness after challenge.

While high rates of abortion have been observed in herds of swine that became infected naturally with *L. pomona,* this symptom has been difficult to produce in artificially infected swine. Ryley and Simmons,[5] in Australia, reported success when the sows were infected intramuscularly in the second half of pregnancy. Ferguson and Powers[6] were less successful. Very early in our studies[7] three gilts in midgestation were inoculated with a laboratory culture of *L. pomona* without producing abortion. In the present experiment, abortion or weak pigs, or both, occurred in four (57.1%) of seven pregnant gilts intraconjunctivally exposed with known virulent *L. pomona* strain S80205. It is believed that both the virulence of the infecting organism and the stage of pregnancy when infection occurred are important factors in determining whether or not abortion will result.

TABLE 2. Leptospirosis Vaccination in Gilts Indications of Infection After Challenge

Gilt No.	Temp. Rise	Leptospiruria Darkfield	Leptospiruria G. Pig	Gestation Outcome
		Group I Antilepto		
1	—		+(1 time)	Normal
2	—		+(2 times)	"
3	—		—	"
4	—		+(1 time)	"
5	—		—	"
6	—		—	"
7	—		—	"
8	—		+(1 time)	"
9	—		—	"
10	—		—	"
		Group II P54874 Bacterin		
11	—		—	Normal
12	—		—	"
13	—		—	"
14	—		—	"
15	—		—	"
16	—		—	"
17	—		—	"
18	—		—	"
19	—		—	"
20	—		—	"
		Group III Unvaccinated Controls		
21	—	—	+(3 times)	Not pregnant
22	+(1 day)	+(5 times)	+(5 times)	Abnormal
23	—	—	+(4 times)	Abnormal
24	—	+(2 times)	+(5 times)	Not pregnant
25	—	—	—	Normal
26	+(1 day)	+(4 times)	+(5 times)	Abnormal
27	+(1 day)	+(1 time)	+(4 times)	Not pregnant
28	—	+(3 times)	+(4 times)	Normal
29	—	+(4 times)	+(5 times)	Abnormal
30	—	—	+(2 times)	Normal

— = Negative results.
+ = Positive results.

The fact that adult swine rarely show physical signs of illness following infection with *L. pomona* was confirmed. The three gilts in the control group that developed a one-day fever following exposure did not appear visibly ill. They continued to eat and any abnormality probably would have gone unnoticed in the herd if temperatures had not been taken daily.

Vaccination against leptospirosis did not interfere with breeding efficiency; all of the vaccinated animals conceived and farrowed litters.

These results suggest that the appropriate time to vaccinate breeding hogs with *L. pomona* bacterin appears to be two or three weeks prior to breeding. Even if prolonged protection is not obtained, vaccination just prior to breeding could provide sufficient protection to sows and

Positive agglutination-lysis test reaction. Most of the leptospires have been agglutinated and/or lysed.

gilts so that normal litters would result; this is what the swine-raiser wants.

In a swine-breeding program where it is desirous to maintain valuable blood lines, animals saved for breeding stock could be vaccinated both at weaning time and again just prior to breeding. In work at this station[7], it was found that leptospirosis blood test negative pigs could be raised from blood test positive sows, provided the pigs were removed from their dams at weaning time and raised on clean ground. Such baby pigs were negative to the blood test at time of birth prior to nursing but shortly after obtaining colostrum they developed titers which approached the titer of the dam. After weaning, pigs again became negative. This prompted the question as to whether these weaned pigs were now susceptible or immune. Subsequent intraconjunctival exposure made three months after weaning revealed that active infection occurred which indicated that such pigs were susceptible. For this reason, vaccination at the time of weaning and again prior to breeding was suggested. An alternative program would be to raise pigs in strict isolation on leptospirosis free-pastures and vaccinate them just once which would be done just prior to breeding. Either of these programs, if carried out diligently, should help a herd recover from an outbreak of porcine leptospirosis.

Whether the bacterin was injected subcutaneously or intramuscularly did not appear to be important in this experiment. Good protection was afforded the gilts in both instances.

The experimental bacterin did not appear to provide better protection to the gilts than that provided by the commercial bacterin when gestation outcome was the yardstick for measuring protection. Thus, it was not considered necessary to use a bacterin prepared from a known porcine strain of *L. pomona*.

Summary

Results of an experiment with two *Leptospira pomona* bacterins used to vaccinate swine against leptospirosis are reported.

Thirty, unbred, Hampshire gilts were divided into three equal lots. Ten gilts were vaccinated with a commercial bacterin, ten received an experimental bacterin, and ten served as unvaccinated controls.

Challenge was by conjunctival sac instillation, using virulent *L. pomona* strain S80205 organisms, during the mid-gestation period.

The protection engendered by the bacterins was measured largely by the outcome of gestation after challenge exposure; however, postchallenge titer rise, leptospiruria, and fever in the gilts were also considered.

The ten animals vaccinated with the commercial bacterin and the ten vaccinated with the experimental bacterin farrowed normal litters. The per cent of baby pigs classified as good at time of birth was 98.9 and 95.7 respectively. Abnormal births occurred following challenge of immunity in four (57.1%) of seven pregnant, unvaccinated, control gilts. Only 49.1% of the baby pigs were classified as good at birth.

Based on postchallenge rise of titer criterion, all vaccinated animals and none of the unvaccinated control animals were protected.

Postchallenge leptospiruria developed in four of the ten gilts vaccinated with the com-

TABLE 3. Leptospirosis Vaccination in Gilts Farrowing Results

Gilt No.	Pigs per Litter No.	Classification: Good	Dead	Weak
		Group I Antilepto		
1	10	10	—	—
2	9	9	—	—
3	10	10	—	—
4	11	10	—	—
5	7	7	—	—
6	9	9	—	—
7	9	9	—	—
8	8	8	—	—
9	9	9	—	—
10	7	7	—	—
Total	89	88(98.9%)	—	1(1.1%)
		Group II P54874 Bacterin		
11	8	8	—	—
12	8	8	—	—
13	6	6	—	—
14	5	5	—	—
15	9	8	1	—
16	10	9	1	—
17	7	7	—	—
18	4	4	—	—
19	5	5	—	—
20	9	8	1	—
Total	71	68(95.7%)	3(4.3%)	—
		Group III Unvaccinated Controls		
21	Not Pregnant			
22	7	—	7	—
23	6	—	6	—
24	Not Pregnant			
25	11	11	—	—
26	7	—	3	4
27	Not Pregnant			
28	9	8	1	—
29	7	—	4	3
30	8	8	—	—
Total	55	27(49.1%)	21(38.2%)	7(12.7%)

mercial bacterin, in none vaccinated with the experimental bacterin, and in nine of ten unvaccinated animals.

None of the vaccinated gilts and three of the ten unvaccinated controls developed fever after challenge.

It was concluded that, under the conditions of this experiment, the commercial bacterin and the experimental bacterin provided a satisfactory degree of resistance against leptospirosis. Leptospiral abortions were prevented by vaccination.

Other observations made in connection with the Leptospira immunization study are reported and discussed.

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Stable Held Responsible for Death of a Thoroughbred

A precedent setting court decision in San Francisco Superior Court recently established the principle of sanitary conditions at race tracks, and may have far reaching effect on the concept of veterinary inspection for racing stables. The case involved the death of a Thoroughbred that died after having contracted gastroenteritis at the Bay Meadow Race Track in San Mateo, Calif.

Alleged in the brief filed in Superior Court and tried by jury was that Romanticon, a well-bred Argentinian, that ran third the first time out, and won the second, had died of gastroenteritis caused by unsanitary conditions in the Bay Meadows barn.

This is the first instance of the principle of sanitary conditions at race tracks being tested in court. The jury action of awarding $10,000. for the loss of the animal can be taken as timely warning that future stable deaths will result in legal action, backed by this precedent setting decision, to establish claims. It also points up the necessity for inspection of premises by trained personnel to prevent the destruction of valuable animals.

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Cattle vaccinated for brucellosis after maturity react to the blood agglutination test for the disease for extended periods, often for life.

Vaccination Of Swine With A *Leptospira Pomona* Bacterin†

THEODORE BURNSTEIN, D.V.M., Ph.D., ROBERT G. BRAMEL, D.V.M., JOHN JENSEN, B.S., West Point, Pennsylvania

IT is now established that *Leptospira pomona* is the primary cause of both bovine and porcine leptospirosis in this country. Furthermore, it has been shown that the disease is readily transmissible from one species to the other when both cohabit the same premises.[1] Thus, it can be concluded that the same strain of Leptospira is capable of affecting either species of animals. A bacterin containing *L. pomona* has been developed which will protect cattle against leptospirosis.[2] It would seem reasonable to expect the same bacterin to immunize swine.

Incidence of porcine leptospirosis, particularly in swine raising areas, appears to be high.[1,3] The disease in most pigs is mild and essentially subclinical.[1] In breeding animals, however, it takes a much more serious form. Pregnant sows can abort, or if parturition occurs, baby pigs may be weak or even dead.[3] Control of leptospirosis by immunization of all breeding animals and younger pigs appears logical since the latter readily develop carrier states following disease and would be a constant source of danger to the rest of the stock. The immunization studies reported here indicate that the bacterin used in cattle is capable also of effectively immunizing swine against leptospirosis.

Materials and Methods

Experimental Pigs. Cross-bred Yorkshire — Hampshire pigs were obtained from our own farm and were known to be free of leptospirosis. They were eight weeks of age at the time of vaccination. Following vaccination, they were kept in pens away from other stock. For the challenge experiment, pigs were placed in isolation units. A commerical ration, free of antibiotics, was fed.

Bacterin. The bacterin came from a production lot.* Cultures used for this bacterin contained approximately 1,000,000,000 leptospires per ml. Pigs were vaccinated with 5 ml. of bacterin.

Challenge Inoculum. In the challenge experiment, pigs were injected subcutaneously with 1.5 ml. of pooled defibrinated blood from guinea pigs at the height of leptospiral infection (*L. pomona*, strain #14927**). This strain is carried by serial passage in guinea pigs. It consistently produces fever and typical lesions three or four days after inoculation.

Isolation of Leptospires. For leptospiral isolation from challenged pigs, blood or urine samples, or kidney suspensions were each injected into groups of three guinea pigs. Temperatures were taken daily. If a febrile response occurred in one or two of the group, these animals were sacrificed and observed for typical lesions and the presence of leptospires in the peritoneal fluids. If the latter were negative, the remainder of the group, and all animals not showing fever, were challenged with blood from a previously infected guinea pig passage. If challenged guinea pigs were refractory, the original sample from the pig was considered to contain leptospires.

Urine samples were examined at frequent intervals by darkfield microscopy as soon as possible after collection, usually within ten minutes.

Serology. The microscopic agglutination-lysis test was employed to detect leptospiral antibodies. Antigen used was a young culture of *L. pomona*, strain T-262, grown in modified Stuarts medium with 10% rabbit serum. Equal portions of inactivated serum and antigen were mixed and incubated for three hours in an incubator at 30C. Tests were read at 150X magnification using a darkfield microscope.

Tests on all serum samples from one experiment were conducted at the same time with the same batch of antigen.

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†From Merck Sharp & Dohme Research Laboratories, West Point, Pa.

*Antilepto — *Leptospira pomona* bacterin prepared by the Biological Production Laboratories, Merck Sharp & Dohme Division, West Point, Pa.

**Received from Dr. H. S. Bryan, University of Illinois, Urbana.

TABLE 1. Agglutination-Lysis Titers of Pigs following Vaccination with a L. pomona Bacterin

Exp.	No. Pigs	Postvaccination Titers +1:10	+1:50	+1:100	1:250	1:500
I	4	1	—	2	—	1
II	14	3	6	3	2	
III	19	6	4	5	3	1
Totals	37	10	10	10	5	2

Experimental

In three experiments, 37 pigs were vaccinated and tested for their serological response to a single 5 ml. dose of bacterin. Antibodies became detectable as early as the sixth day and appeared to reach a peak on the 14th to 17th day. During the period of these experiments, there was little or no reduction in titers once a peak was reached. Titers reached as high as 1:500 but for the most part varied from 1:10 to 1:100.

Table 1 summarizes the maximal serological responses induced by the bacterin.

Preliminary experiments had shown that in swine the antibody levels produced by the bacterin were relatively low, comparable to those of vaccinated guinea pigs and cattle. The subcutaneous route of vaccination is generally used. It seemed of interest to compare antibody responses of pigs injected by the subcutaneous route to that of others vaccinated intramuscularly. In experiment 2, seven pigs were inoculated subcutaneously and seven intramuscularly. Animals were bled weekly for seven weeks. There was no significant difference in the two groups. Thus they were included together in table 1.

In diagnostic screening of blood samples for leptospiral antibodies, it is a common practice in many laboratories to include only titers of 1:100 or more as being indicative of specific leptospiral antibodies. In the vaccinated animals above, several prevaccination bleedings were negative for either agglutination or lysis. However, following vaccination, serums of several animals diluted 1:10 agglutinated and lysed the antigen. Therefore, it is felt that the reaction is specifically one of a leptospiral antigen-antibody combination.

Challenge Experiment. The 14 pigs in experiment 2 and 5 unvaccinated controls were challenged 48 days postvaccination. Animals were placed in isolation units with the controls separated from vaccinated pigs. Body temperatures were recorded twice daily. Within 24 hours of the time that any of the controls exhibited a rise in temperature, all controls and the six vaccinated pigs with the highest temperature were bled for leptospiral isolation. Three urine samples, collected at weekly intervals from each of the same 11 animals, were also tested for Leptospira by guinea pig inoculation. Urine from all pigs was examined frequently with a darkfield microscope. Bleedings were also collected for serology. Five

TABLE 2. Signs of Leptospirosis in Vaccinated Pigs after Challenge

Temp. Rise	Leptospiremia	Leptospiruria D.F.[2]	Leptospiruria G.P.[3]	Interstitial Nephritis	Leptospira in Kidneys
Group I Vaccinated Subcutaneously					
1 Neg.	NT[1]	Neg.	NT	Neg.	NT
2 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
3 Neg.	NT	Neg.	NT	Neg.	NT
4 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
5 Neg.	NT	Neg.	NT	Neg.	NT
6 Neg.	NT	Neg.	NT	Neg.	NT
7 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Group II Vaccinated Intramuscularly					
8 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
9 Neg.	NT	Neg.	NT	Neg.	NT
10 Neg.	NT	Neg.	NT	Neg.	NT
11 Neg.	NT	Neg.	NT	Neg.	NT
12 Neg.	NT	Neg.	NT	Neg.	NT
13 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
14 Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Group III Controls					
15 Pos.	Pos.	Pos.	Pos.	Pos.	NT
16 Pos.	Pos.	Pos.	Pos.	Pos.	NT
17 Pos.	Pos.	Pos.	Pos.	Pos.	NT
18 Neg.	Neg.	Neg.	Neg.	Neg.	NT
19 Pos.	Pos.	Pos.	Pos.	Pos.	NT

[1]NT — Not Tested [2]Darkfield Microscope [3]By Guinea Pig Isolation

weeks after challenge, all pigs were sacrificed and autopsied. Kidney suspensions from the six vaccinated animals that were tested for leptospiral isolation were inoculated into guinea pigs. Since leptospiruria had been demonstrated in the controls at the time of autopsy, it was not considered necessary to test the kidneys for leptospires.

Seven to eight days after challenge, four of five controls responded with abnormal temperatures ranging from 104.5 to 105.8 F. The temperature response lasted from several hours to two days. Leptospires were isolated from the blood of four of the controls. Urine samples from the same four controls were positive on the 13th day postchallenge. Organisms seen under darkfield were sluggish in their movements. This was probably due to the fact that the urine was acid. The fifth control showed neither leptospiremia nor leptospiruria. The vaccinated pigs did not exhibit temperatures above 103.6 F. The six animals tested for leptospiremia at the time their temperatures were highest (103.2—103.6 F) were negative. None of the vaccinated animals was found to have leptospiruria.

At autopsy, the only changes noted were in the kidneys of the controls. The four controls from which leptospires had been isolated suffered extensive interstitial nephritis. The surfaces of the kidney were covered with numerous whitened areas of varying sizes. These are typical of the changes seen in the convalescent stage of the experimental infection.[1]

The clinical and laboratory data are presented in table 2 and summarized in table 3.

Serology. In this experiment, maximal titers of vaccinated pigs once reached did not change to any great extent during the prechallenge period. Following challenge, vaccinated animals tested at two days showed a slight rise in titer. Antibodies in the controls were not detected until day 14. Later tests of the controls showed titers of 1:16000 or more. The ultimate titers of the vaccinated pigs, however, were considerably less than those of the controls. The control pig (no. 18), which had not shown other signs of leptospirosis, had a strong antibody response, and thus was considered to have gone through the disease.

The serologic studies are shown in table 4.

Discussion

Young pigs following a single dose of bacterin developed agglutination-lysis titers ranging from 1:10 to 1:500. The antibody response was comparable to that of vaccinated cattle and swine in that relatively low titers were produced.[2] In cattle after a period, there is a drop in titer to a nondetectable level in some animals. However, it has been shown that vaccinated cattle without detectable antibodies are immune to challenge.[6,7] This fact suggests that the *in vitro* agglutination-lysis antibody may not necessarily be the one that protects, or at least, that a large amount of antibody is not necessary for protection. In the short-term swine studies reported here, the antibody levels remained fairly constant during the seven weeks of the experiment. In the pigs with low titers (1:10 to 1:50), it is probable that antibodies would have become nondetectable had the experiments been allowed to continue. One wonders whether or not vaccinated pigs without titers would be immune. The fact that 1:10 titers are protective and that vaccinated cattle and guinea pigs lacking titers are immune suggests that they also would resist infection.

TABLE 3. Summary of Signs of Leptospirosis in Challenged Pigs

				Isolation of Leptospira from		
	Fever	Nephritis	Blood	Urine D.F.	Kidney G.P.	
Vaccinated Pigs	0/14	0/14	0/14	0/14	0/6	0/6
Control Pigs	4/5	4/5	4/5	4/5	4/5	N.T.

Numerator — number positive. Denominator — number tested.

The question of duration of immunity following vaccination of swine becomes important. Cattle have been shown to be immune to challenge 12-14 months after vaccination.[7] It is possible that pigs could similarly be immune for a year. In areas where leptospirosis is enzootic, exposures to carrier animals would aid also in prolonging the immunity of vaccinated animals.

The fact that infection in nonbreeding swine is essentially inapparent makes the infected individual a dangerous one. Most pigs after having survived leptospirosis become carriers.[1] It is probable that the carrier state in many animals lasts a lifetime.[1,5] There is some evidence that the carrier state can be eliminated with certain antibiotic therapy.[3] However, until this becomes practical on a large scale basis, leptospirosis will not be controlled by therapeutic means.

At the present, vaccination appears to be the logical approach to control. A program might include the vaccination of all pigs in enzootic areas after weaning. They would probably be protected until breeding age. Then animals kept primarily for breeding should be revaccinated to protect their progeny. At the start of the program, if infection exists in a drove, it might be wise to treat infected animals with appropriate antibiotic therapy.

Summary

A bacterin containing *Leptospira pomona* was shown to be effective in immunizing young swine. A single dose of bacterin, administered either subcutaneously or intramuscularly, produced serological responses in 37 pigs with agglutination-lysis titers ranging from 1:10 to 1:500.

Fourteen vaccinated animals and five controls were challenged with a virulent strain of *L. pomona*. Pigs receiving bacterin exhibited no signs of leptospirosis, whereas a rise in temperature, leptospiremia, leptospiruria, interstitial nephritis, and serologic responses typical of active infection were noted in four of five controls.

An approach to the control of porcine leptospirosis has been discussed.

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Mismanagement Invites Losses From Parasitism

Reviewing matters pertaining to losses from parasitism, Shumard[6] recites "costly mistakes" by livestockmen relating to some mismanagement factors. Emphasized is the necessity for composting manure for at least two years before spreading on pastures. If used early, it should be applied only to field to be cultivated.

[6]Shumard, R. F., Costly Mistakes. Bi-Monthly Bul., N. D. Agri. Exp. Sta., 28:179, 1956.

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TABLE 4. Serological Response of Pigs Following Vaccination and Challenge

Route of Vac.	Pig No.	Agglutination-Lysis Titers							
		Pre. Vac.	Highest Post-Vac.	At Chall.	Postchallenge Days *2	7	14	21	35
Subcut.	1	0+	10	10	50	50	10	50	10
	2	0	50	10	50	50	100	500	500
	3	0	50	10	50	50	2000	4000	2000
	4	0	200	50	200	200	200	200	200
	5	0	200	200	400	800	8000	8000	8000
	6	0	10	10	200	500	500	500	200
	7	0	50	50	100	100	4000	2000	2000
Intra-musc.	8	0	100	50	200	800	4000	4000	4000
	9	0	10	10	50	50	50	50	10
	10	0	200	200	400	400	800	800	500
	11	0	200	200	400	800	800	800	200
	12	0	200	200	200	100	100	100	100
	13	0	50	50	200	500	500	500	200
	14	0	50	50	200	200	100	100	50
Controls	15	0	0	0	0	0	10000	>64000	>64000
	16	0	0	0	0	0	10000	>64000	>64000
	17	0	0	0	0	0	8000	16000	16000
	18	0	0	0	0	0	10000	>64000	>64000
	19	0	0	0	0	0	16000	32000	>64000

*Challenged. + Negative at 1:10.

Practical Application Of Serological Tests For Leptospirosis In Veterinary Practice†

JAMES W. NEWBERNE,* D.V.M., M.S., Zionsville, Indiana

VARIOUS aspects of leptospirosis in domestic animals (*i.e.* incidence, epizootiology, symptoms, pathology, diagnosis, treatment, and control have been adequately described and reviewed by a number of independent investigators.[1-14] Although loss of dogs, and possibly horses, from leptospirosis is important from a sentimental aspect, this is largely overshadowed by the economic importance of the disease in cattle and hogs. The incidence and the economic importance of *Leptospira pomona* infections in cattle and hogs have been established and reported by a number of authors.[1-8, 6-7]

When the problems related to public health are excluded, the immediate practical considerations of the disease in domestic animals are; (1) definitive diagnosis, and (2) appropriate therapeutic and/or control measures.

Several diagnostic methods employed early are used currently. The difficulties entailed in the performance of, and the questionable information obtainable from, darkfield examination of suspected material is well known. Direct culture methods, with or without concomittant animal inoculation, have proved satisfactory but have the disadvantage of being time consuming. Consequently, serological methods designed to detect the presence of leptospiral antibodies are receiving increasing attention and use. Experience has shown that when serological results are judiciously correlated with symptoms which leptospiral infections are known to produce, that immediate practical assistance in the recognition of the disease is afforded.

Serodiagnostic Methods

Agglutination-lysis and complement-fixation methods have been employed widely. More recently, modified rapid-plate and capillary-tube methods have been developed by Stoenner.[8] These latter tests utilize the agglutination phenomenon. The investigations of York and Johnston[9] indicate that the complement-fixation and agglutination-lysis methods, using *L. pomona* antigen, may be used interchangeably (table 1). Remarkable correlation also was shown (table 2) when canine sera were tested by a plate agglutination, the agglutination-lysis, and the complement-fixation methods, using *L. canicola* antigen. More recently the author investigated the comparative value of the agglutination-lysis method, Stoenner's rapid-plate method, and Stoenner's capillary-tube method for testing both bovine and porcine serum, using *L. pomona* antigen (table 3). There was significantly close agreement among the three methods employed.

Analysis of the above results reveals that the agglutination-lysis method compares favorably with the complement-fixation technic when bovine and canine sera are used. Moreover, the agglutination-lysis method, serving as the classical comparative method, compares favorably with the Stoenner rapid-plate and Stoenner capillary-tube methods when bovine, canine, or porcine sera are used. Consequently, in our laboratory the more cumbersome agglutination-lysis method has been discontinued in favor of the Stoenner methods. Currently all sera are screened by the rapid-plate method and the titers of positive reacting sera are established by the capillary-tube method. The antibody titer may similarly be determined by the plate-dilution test.

The rapid-plate method appears to be a promising tool for screening purposes in herd outbreaks, as well as in survey work. A single antigen which may be used for the rapid-plate,

TABLE 1. Comparison of Agglutination Test and Complement Fixation Test with Serum of Cattle Using *Leptospira pomona* Antigens. (After York and Johnston[9])

Serum No.	End-Point Dilutions Complement-Fixation	Agglutination-Lysis
30	0	0 to 1:80
10	1:4	1:100 to 1:200
12	1:8	1:200 to 1:400
12	1:16	1:400 to 1:800
20	1:32	1:800 to 1:1600
8	1:64	1:1600 to 1:3200
12	1:128	1:1600 to 1:6400
6	1:256	1:6400

†Presented at the 27th annual meeting of the Florida State Veterinary Medical Association, Pensacola, September 23-25, 1956.

*Pathology Research Laboratory, Pitman-Moore Company.

TABLE 2. Development of *Leptospira canicola* Antibodies in Experimentally Infected Dogs. (After York and Johnston[9])

Test	Days after Inoculation 0	5	10	15	20	25	30
Complement-fixation	0/18*	5/18	17/18	18/18	18/18	18/18	18/18
Agglutination-lysis	0/18	6/18	18/18	18/18	18/18	18/18	18/18
Plate-agglutination	0/18	4/18	17/18	17/18	17/18	17/18	17/18

*Numerator—Number of dogs reacting to test.
Denominator—Number of dogs tested.

the plate-dilution and the capillary-tube methods is now commercially available. This should provide general assistance in two areas: (1) Improve correlation of serological surveys due to standardization of the antigen employed, and (2) establish a means whereby the practitioner can perform rapid-plate screening tests in the field. In cases where positive reactors appear and when added serodiagnostic information is desired, one can enlist the aid of a diagnostic laboratory to establish titers of the reacting sera.

Interpretation and Application of Serological Results

As has been described elsewhere,[1-7] the variation in clinical signs makes leptospirosis a disease which at times can be readily diagnosed by the veterinarian but in other instances can be completely overlooked. In addition, a "carrier" or "shedder" condition can be present regardless of the severity of the illness in the host. This may exist for as long as three months in cattle, and six months in swine and dogs.

When clinical signs suggestive of leptospirosis appears in a herd of cattle or swine, serological tests should be made. Judicious correlation of test results with existing symptoms should, in most cases, afford sufficient evidence for a subjective diagnosis. In cattle, for example, should the clinical signs include abortion, atypical mastitis, and perhaps death of young animals exhibiting hemoglobinuria, positive serological tests should be strongly suggestive. In the case of abortion, this suggestion would be further supported should the subject animals fail to show serological evidence of brucellosis or vibriosis. Since the disease in swine is characterized primarily by abortion without clinical evidence of illness, positive serological tests of a number of aborting sows is again strong suggestive evidence that leptospiral infection might be present. As with cattle, this suggestion is again supported should the same animals fail to show serological evidence of brucellosis. In general, a positive test indicates that the animal has experienced a leptospiral infection and produced antibodies. The antibodies first appear about ten to 14 days after initial infection, continue to rise until about the fourth week, then gradually decline, but often persist for several years. Whenever possible, it is desirable to test "paired" samples, in which case one sample is tested as early as possible in the course of the disease and a second one a week or more later.

Since leptospirosis in dogs is usually observed in individuals rather than groups, it is necessary in the process of diagnosis to apply considerably more attention to the elimination of diseases which might elicit similar clinical signs. As with cattle and swine, it is advantageous to test paired sera whenever possible. A significant rise in titer indicates that leptospiral infection is present.

Treatment

It is generally agreed that treatment of known or identified cases of leptospirosis in any species might include an appropriate antibiotic during the septicemic stage. Streptomycin has been recommended for the elimination of carrier or shedder stages.[12-14] The former point is extremely important in the treatment of cattle and dogs exhibiting decided clinical signs. The latter is obviously important in any affected species which persistently excrete organisms.

Immunization and Control

Burnstein and Baker[3] reported that swine may excrete many more organisms than calves and over longer periods, thereby serving as a persistent source of infection. Since the persistent excretion of organisms represents a

TABLE 3. Comparative Tests for *Leptospira pomona* Antibodies Using; (1) the Stoenner Rapid-plate, (2) the Stoenner Capillary-tube, and (3) the Agglutination-lysis methods.

Method	Bovine Sera	Porcine Sera
1. Rapid-plate	110/252*	61/148
2. Capillary-tube	114/252	64/148
3. Agglutination-lysis	106/252	68/148

*Numerator—Number sera positive
Denominator—Number sera tested
Positive test—Plate agglutination; C-T 1:40 >; A-L 1:100 >.

TABLE 4. Vaccination of Experimental Animals with *Leptospira pomona* Vaccine (After York, *et al.*[11])

	No. of Animals	Pre-vaccine Titer	Post-vaccine Titer Range†	Effect of Challenge (Clinical Signs)
Calves (Vaccinated)	21	0/21*	1:20 to 1:160	0/21
Calves (Controls	20	0/20		18/20
Pigs (Vaccinated)	20	0/20	1:40 to 1:320	N.T.

*Numerator—Number of animals showing reaction. Denominator—Number of animals tested. †Test by agglutination-lysis technic. N.T.—Not tested.

potential danger to all susceptible species which might come in contact with shedders, prophylaxis assumes a position of considerable importance in control. The development of a satisfactory *L. pomona* bacterin* has paved the way for successful immunization of animal against this disease. Experimental data accumulated incident to the development of the *L. pomona* bacterin[10-11] indicate that a satisfactory antibody response can be stimulated both in cattle and swine (table 4). Although titer resulting from vaccination is generally slightly higher in swine than in cattle, in neither species has it been shown to be sufficiently high to interfere seriously with routine serological tests.

In general, vaccination with *L. pomona* bacterin is recommended in the following conditions: (1) In herds of cattle known to be infected, (2) in commercial herds to which replacements are continually being introduced and on newly constituted herds assembled from different sources, (3) in herds on property adjoining that on which the disease exists, specifically if there is a common fence or stream, (4) in cattle to be added to an infected herd, (5) in all cattle to be taken to and returned from sale barns, fairs, or shows, (6) in cattle fed in feeder lots and especially those on feeder lots where both cattle and pigs are fed, and (7) in herds in which there is a possibility of exposure to deer.

Summary

Comparison of the various currently employed serological tests for the detection of Leptospira antibodies is made and the practical application of test results to the existing field conditions is considered. Procedures for the possible treatment, immunization, and control of leptospirosis are briefly discussed.

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The California Board of Agriculture has urged rebuilding of the international livestock fence between California and Mexico to prevent Mexican cattle from drifting across the boundary.

Dr. James E. Stuart, Chief of the Division of Animal Industry, stated that tick infested cattle from Mexico were responsible for a developing situation having serious potential. Stockmen using range adjacent the border were required to expend rather large sums of money for treatment of infested stock.

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Ten different species of disease-carrying insects have now developed immunity to insecticides normally used to exterminate them.—*S. N. L. 11/3/56.*

Present Day Role Of The Veterinarian In Public Health†

BERWYN F. MATTISON, M.D., M.P.H., and ERNEST J. WITTE, V.M.D., M.P.H., Harrisburg, Pennsylvania

THE current concept of veterinary public health is a relatively new one, actually only about a decade old. The American Board of Veterinary Public Health has defined it as "comprising all the community efforts influencing and influenced by the veterinary medical arts and sciences applied to the prevention of disease, protection of life, and promotion of the well-being and efficiency of man." Traditionally, veterinary medicine has always made a contribution to protecting the health of the public by animal disease eradication procedures and by animal and food inspection programs. In many instances these had agricultural economics as their primary basis with advantages to public health programs being incidental. An attempt to modify this situation was made by public health administrators who saw the advantage of integrating veterinarians trained in public health into general health programs. As a result over 35% of our states now have full-time public health veterinarians functioning at the state level. There are at least 400 others doing full-time public health work. It has been estimated that about 1,400 more are needed.

Veterinary public health is concerned with any linkage between human and animal health problems. In broad terms the principal functions of the public health veterinarian may be defined as follows:

(1) The provision of expert technical service and the promotion of activities in the control and eradication of zoonoses.

(2) In collaboration with other specialized personnel the development and supervision of food sanitation practices, with particular reference to diseases transmissible from animal to man.

(3) The coordination of work and resources of groups or agencies, private or official, dealing with coinciding interests of human and animal health.

(4) The education and training of professional and auxiliary workers in veterinary aspects of public health.

The Expert Group on Zoonoses of the World Health Organization has listed over 80 diseases naturally transmissible between animals and man. The importance of these varies in different parts of the world. In North America only about one third are of any significance to man.

Zoonoses have unique characteristics. They may be transmitted by direct contact with an infected animal, by contamination through infected animal discharges and secretions, by arthropod vectors or rodent hosts serving as a link between the animal reservoir and the human host, by contamination of air and water, and by consumption of infected animal products. Another characteristic of zoonoses is that once the infection occurs in man, there is rarely person-to-person transmission. It has also been noticed that the highest incidence of these diseases occurs in individuals whose occupations bring them into contact with animals or their products. Finally, it is also possible for human beings to transmit to animals diseases which would not otherwise occur among the animal population. The most direct method of attack to eliminate these zoonoses in man is to eradicate the infections in the animals. While this job is reasonably possible in domesticated animals, it presents a far greater problem when wild species are known to be involved or when wild animal reservoirs are suspected.

The more important zoonoses in this part of the country include rabies, brucellosis, anthrax, bovine tuberculosis, leptospirosis, psittacosis, trichinosis, Q fever, salmonellosis, tularemia, and Rocky Mountain spotted fever. A few of these will be touched upon briefly to emphasize some of the veterinary problems in public health.

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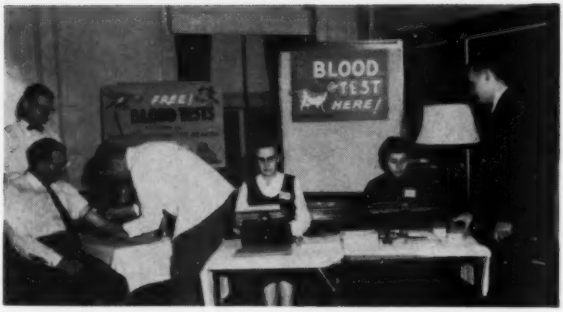
†Presented at the 73rd annual convention of the Pennsylvania State Veterinary Medical Association, Harrisburg, October 13, 1955. Doctor Mattison is Secretary of Health; Dr. Witte is chief, Veterinary Public Health, Department of Health Section, Commonwealth of Pennsylvania.



Blood testing of veterinarians attending the 73rd Annual Convention of the Pennsylvania State Veterinary Medical Association, Harrisburg, Oct. 13, 1955. Serum samples were run for evidence of pittacosis leptospirosis, brucellosis, tularemia, and Q fever.

Rabies

Rabies is an ancient disease but still remains a major challenge to health authorities as well as to agriculturists and conservationists. The health officer measures seriousness of the rabies problem not alone by mortality statistics, but rather in terms of the hundreds of potentially exposed receiving antirabies prophylaxis with consequent occasional complications, expense, man work-hours lost, and considerable mental turmoil in the patient and his family. Here is a problem which can not be solved without the participation of the veterinarian, be he private practitioner, member of an agricultural agency, or public health veterinarian. The latter can be of particular assistance to the health officer because of his closeness to the human problems created by a rabies scare and because of his working relationships to veterinary groups. He is of value as a consultant, advisor, and investigator. Veterinarians orientated in public health have encouraged the development of newer antirabies biologics and diagnostic technics which represent the principal advance made in rabies control in recent years. The discovery of rabies in bats in this state and others may lead to a better understanding of the epidemiology of this disease. Additional progress is eagerly awaited in controlling wildlife rabies.

Brucellosis

Many think that brucellosis will eventually go the way of bovine tuberculosis and will soon become a disease of minor significance to both animals and man. Encouraging signs that this is occurring are appearing on the horizon. Veterinarians are in the front line of both detection of and attack on this health problem. They are in an admirable position to educate owners, farm laborers, and the farm housewives on methods of human disease prevention and animal disease eradication. Here is another situation in which health and agricultural agencies can join forces to conquer a common enemy.

Food Inspection

A public health program on a state or local level is not complete without the assurance of a wholesome milk and meat supply at all times. The most important purpose of milk and meat sanitation is to prevent transmission of disease to man and, as such, must be considered a public health function.

However, the administrative pattern varies in different localities and the important thing is to have effective health protective services. Milk sanitation supervision should begin with the cow on the farm and end with the product in the consumer's possession. The supervision of meat sanitation should begin when the animal enters the slaughterhouse and terminate when the food product is delivered to the consumer. Milk and meat inspection systems have aided in diminishing the incidence of scarlet fever, diphtheria, typhoid, streptococcal sore throat, bovine tuberculosis, brucellosis, tularemia, salmonellosis, and anthrax, these in addition to less important infections. The veterinary profession must be recognized as playing a leading part in controlling these public health problems. Continued collaboration of the veterinarian with epidemiologists, sanitary engineers, bacteriologists and other specialists will maintain our accomplishments and assure additional progress.

Practitioner's Role in Public Health

Repeated and protracted crises in world affairs have made it necessary to establish civil defense forces. Training and experience make the veterinarian well qualified to accept significant responsibilities in this area. Because of his knowledge of diseases of both food animals and zoonoses the public health veter-

inarian is particularly equipped to serve on epidemiologic teams along with physicians, nurses, and other professional workers in the event of biological warfare.

He will also be the first one in the field to diagnose and report the occurrence of unusual animal epidemics, possible clues to biological warfare. In this respect animal morbidity reporting becomes an important device. In many areas his practice in venipuncture is being used in planning civil defense blood service programs.

The veterinarian's skills can be used in connection with general sanitation, animal and vector control, food safety as well as for radiation and chemical problems affecting food animals. Finally, we must not forget the veterinary practitioner whose modern hospital facilities and services can be utilized in civil disasters to aid the sick and wounded.

Our discussion has suggested that these public health problems having a veterinary basis can not be resolved promptly into areas of human and veterinary medicine. Both groups of talents must be used and coordinated. This coordination function is of particular concern to the public health veterinarian whose primary interest is animal health as it affects human health whereas others are interested mainly in only one facet of the total picture. Coordination of the human and animal health fields results in economy of effort and extended activities. Problems of the zoonoses are better met by the cooperative efforts of all interested groups rather than by one group alone. This has been particularly noticeable in rabies control programs where the public health veterinarian attempts to coordinate the efforts of medical and veterinary practitioners, diagnostic laboratories, civic organizations, public health and agricultural groups, and conservation officials.

The Future

What of the future? There still remains much to be contributed by the veterinarian to

PENNSYLVANIA DEPARTMENT OF HEALTH
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VACCINATE
Help to control
RABIES
Rabies
EVERY YEAR
Annual Shot
for Rabies Control
Start with YOUR DOG
Vaccination of animals against Rabies is recommended by the Pa. State Veterinary Association.
Continous Showing of Films by Dept. of Health
ENTRANCE
MOVIES
RABIES
KILLS
LIVESTOCK
A LOCAL RABIES CONTROL PROGRAM SHOULD INCLUDE...
1. Impounding and humane destruction of all stray and ownerless dogs.
2. Annual anti-rabies vaccination of all dogs.
3. Licensing of dogs.
4. Strict quarantine of all dogs in a community where there is a rabies outbreak.
STATE ASSISTANCE IS AVAILABLE

public health. Although communicable diseases are no longer the problem they were ten or 20 years ago, there are many still to be conquered. And many of these are in the field of zoonoses. Questions relative to histoplasmosis, toxoplasmosis, salmonellosis, Q fever, for example, as well as numerous virus diseases remain unanswered. In the field of noninfectious diseases there are many diseases of man which have counterparts in animals, such as heart and circulatory disturbances, malignancies, diabetes, nephritis, cirrhosis, and goiter to mention a few. Satisfactory communication between veterinary and medical groups working on similar problems are not always established. This should be encouraged for the benefit of both.

Veterinarians in local health departments should be used more efficiently. Surveys show they function primarily as food inspectors. This function utilizes but one part of their training and ability. Local health officers can broaden the veterinarian's scope of responsibility to include epidemiologic investigations and survey work. More help should be sought from the private practitioner in rabies control programs, disease investigations and animal morbidity reporting. And finally, where the ability and experience justifies it, the veterinarian can function in a broad public health administrative role. Recently a public health veterinarian was made assistant to the commissioner of health in a midwestern state.

It appears advisable that curricula in veterinary schools present material which will acquaint veterinary students with general public health programs and their administration. The graduate schools of public health have opened their doors to the veterinary profession and hope to see a constant flow of public health veterinarians into public service.

Field research in public health needs the special skills that veterinary medicine can supply. All too few of a health department's full time staff are well grounded in laboratory science. The increasingly complex technics of bacteriology, virology, and serology are more important than ever in planning health protection programs and their evaluation.

Let us take an example. In many parts of the country the handling of milk on the farm is being revolutionized. This is the result of two relatively recent developments: Closed system "pipe-line milking" and bulk tank cooling. Putting the two together has meant a rapid cooling of milk almost immediately after it leaves the cow — and with little chance of outside contamination. It is a far cry from hand-milking into open pails and 40-quart cans cooled in the spring milk house.

But this change in handling has resulted in unbelievable low bacteriologic counts using standard milk analysis methods. A couple of years ago the senior author questioned the efficacy of our traditional laboratory tests of raw milk quality under those conditions feeling that the pooling and rapid cooling might mask the excessive bacterial growth which we used to rely on, along with direct microscopic examinations, to pick up mastitis milk.

With the help of a public health veterinarian on our staff two dairy herds on farms using bulk tank cooling were selected — one with a previously recognized mastitis problem, the other presumably "clean." Individual quarter samples on every cow were taken with a recorded physicial examination of each animal in both herds. It was thus established that over a third of one dairy was suffering from clinical mastitis, with no diseased animals in the other. But when routine raw milk samples were collected from the tank coolers on both farms, both sets were reported by two approved laboratories as meeting generally accepted standards. This finding has led to a reappraisal of laboratory milk testing standards in light of current milk handling practices.

This is but one example of what significant results can be expected from a team approach to field research when veterinary skills are available. There is probably a rather special reason for this: The training and experience in your professional curriculum emphasizes "herd" disease. The epidemiologic approach is thus undoubtedly easier for the veterinarian than it is for most medical graduates.

Because we have been discussing public health program activities, rather than the broader concept of the health of the public, no mention has been made of the key role played by the veterinarian in maintaining our animal food supply or our supply of products from animal sources, like hides, furs, leather, and medicines. All of these benefits also contribute to the health of the public.

Summary

The public health veterinarian is one of the newer members of the community health team. He brings to the team a combination of basic science, special diagnostic and therapeutic skills in controlling zoonoses potentially dangerous to man, and a concept of disease and health in aggregates of animals or individuals. His role is expanding and it is fervently hoped his numbers will continue to increase.

Tests Involving The Oral Administration Of Phenothiazine, Hexachloroethane And Di-N-Butyltin Dilaurate For The Control Of Cattle Grubs†

N. G. COBBETT, D.V.M., H. O. PETERSON, D.V.M., MS., and E. M. JONES, D.V.M.

CURRENTLY recommended methods for control of cattle grubs involve destroying the larvae of Hypoderma spp. by application to infested cattle of rotenone-containing materials in sprays, washes, dips, or dusts. Control by such methods requires properly timed treatments during the grub season, as well as the treatment of all infested cattle in an area. In most instances, such programs have produced a significant reduction in grub populations within the designated area so long as the programs were continued year after year. It has been evident, however, that a simpler and more practicable method of destroying cattle grubs must be found if cattle owners are to become enthusiastic about controlling this costly and widespread pest.

During recent years, some investigators reported fewer grubs in cattle that were treated for internal parasites with certain anthelmintics than in untreated controls. Worden[1] reported the successful control of cattle grubs in two herds in England that he had drenched for internal parasites with a preparation that contained phenothiazine, hexachloroethane, and di-n-butyltin dilaurate. Schwartz, Porter and Herlick[2] observed that cattle having free choice access to a phenothiazine mineral mixture during the grazing season, and thereafter fed a phenothiazine-grain supplement at the U. S. Regional Animal Disease Research Laboratory, Auburn, Alabama, during 1951-52 and 1952-53 seemed to have fewer cattle grubs than control groups of similar animals that received no phenothiazine in their diet.

The observations of Worden and of Schwartz *et al.*, were considered sufficiently encouraging to warrant further trials of the drugs they used. Since the data by Worden were obtained from drenching with a combination of phenothiazine, hexachloroethane, and di-n-butyltin dilaurate, and those of Schwartz and coworkers from feeding phenothiazine in mineral and grain mixtures, it was decided to test each drug separately. Pilot tests were carried out in 1953-54 at the Albuquerque Station of the Animal Disease and Parasite Research Branch, and two large-scale field tests were conducted on New Mexico ranches in 1954-55 and 1956. In this report, the pilot tests are designated as experiment A, and the two field tests as experiments B and C. The latter involved only the daily administration of phenothiazine in pelleted cattle feed. Experiment B was conducted on cattle in a ranch feed lot at Portales, New Mexico, and was designed to determine the effect of the phenothiazine on grubs when fed during the heel fly season and the early migratory period of the grubs. Experiment C was conducted on a ranch near Albuquerque to test the effectiveness of phenothiazine when administered during the time that grubs were in the backs of infested cattle.

Procedure

Experiment A. In November 1953, 24 grade Hereford range calves were brought to the Albuquerque station, ear-tagged, and divided into six groups of four animals each. All had grubs, the average infestation being 20 per animal. All groups were confined in small, adjoining individual pastures comprising a total of only 4 acres. Therefore, all mature grubs that dropped from the calves fell in a relatively small area, thus insuring that all cattle on the premises would be equally subjected to heel fly strike during the subsequent spring months.

It was assumed that, if the drugs to be tested had any deleterious effect upon cattle grubs, this would probably occur during early migration of the larvae through the body tissues.

†Animal Disease and Parasite Research Branch, Agriculture Research Service, United States Department of Agriculture, Post Office Box 705, Albuquerque, New Mexico.

Accordingly, the drugs were administered during the period of heel fly strike and the early migratory period of the grubs. To be certain of proper timing, treatments were begun on January 7, 1954, well in advance of the heel fly season and continued through June, well after the season ended.

Two groups of calves, groups I and II, received phenothiazine that had been incorporated into cattle pellets at the rate of 2 gm. per lb. of pellets. In order to be sure that each calf received its allotted amount of phenothiazine, the medicated pellets were fed in outdoor mangers equipped with individual stanchions and feed boxes. Each calf in group I received 2 gm. of phenothiazine daily by consuming 1 lb. of the medicated pellets, and over a 175-day feeding period, each ingested a total of 350 gm. of the drug. The calves in group II received twice that amount of the drug, namely 4 gm. per day, by eating 2 lb. of the medicated pellets for the same period of time.

Each calf in group III received six monthly drenches, each of which contained 60 gm. of phenothiazine, a total of 360 gm. during the course of treatment. Those in group IV received the same number of monthly drenches containing 37 gm. per dose of hexachloroethane, a total of 222 gm. The calves in group V were similarly treated with 50 gr. doses of di-n-butyltin dilaurate, receiving a total of 300 gr. or 19.4 gm. The calves in group VI received no medication and served as controls.

Experiment B. Early in December 1954, three groups of Herefords, one to two years of age, were selected for the test. Each group was confined in a separate pen. Groups I and II each consisted of 30 individually marked animals and group III of 60 individually marked cattle. Beginning on December 15, 1954, which was well in advance of the heel fly season and ending on April 20, 1955, well after the heel fly season was over, groups I and II, the principals, were fed alfalfa-grain pellets into which phenothiazine had been incorporated. During the same period, group III, the controls, was fed the same pellets that contained no phenothiazine. The pellets were fed at the rate of 2 lb. per animal per day in open troughs for 125 days. The animals in group I received pellets that contained 1 gm. of phenothiazine per lb., which they ate readily, thereby consuming an average of 2 gm. of the drug per animal per day, a total of 250 gm. each during the feeding period. The animals in group II were given pellets that contained twice as much phenothiazine, 2 gm. per lb. of pellets. However, they did not eat these pellets readily and consumed only enough of them during the 125 day period to ingest an average of 2.6 gm. per day per animal, a total of 325 gm. per animal.

Unfortunately, the owner found it necessary to dispose of some of the animals involved in this experiment during the summer of 1955. As a result, only 27 principals in group I, 10 in group II, and 34 controls in group III were available for evaluating the results of the test the ensuing grub season during the fall and winter of 1955-56.

Experiment C. In this field test, 40 Hereford range cattle, varying in age from coming yearlings to mature cows, were selected and marked for identification. The animals were divided into two groups, each of which contained cattle of various ages. Each group was confined in a separate pasture where ample dry winter grasses were available. Group I, the principals, consisted of 19 animals, and group II of 21 controls. On November 23, 1955, all the animals were examined for grubs. The few grubs then present were recorded. It was determined by extracting grubs from some of the most prominent cysts that most were in the second instar stage, and only a few were in the early third instar stage.

Between November 25, 1955 and December 28, 1955, a period of 34 days, animals in group I received alfalfa grain pellets into which phenothiazine had been incorporated at the rate of 2 gm. per lb. of pellets. The pellets were fed in open feed troughs and the animals readily ate an average of 2 lb. of pellets per animal per day, an average daily consumption of 4 gm. of phenothiazine per animal. Each animal, therefore, consumed a total of 136 gm. during the 34 day feeding period. Beginning on December 29, 1955, the cattle in this group were fed pellets containing twice the amount of phenothiazine, or 4 gm. per lb. These pellets were prepared by mixing into the feed at the rate of 4 gm. per lb. a commercial phenothiazine product containing 98.5% phenothiazine and 1.5% flavoring agent. The older cattle in the group readily ate an average of 2 lb. of these pellets per animal per day, thereby consuming an average of 8 gm. of phenothiazine daily. The calves refused to eat the pellets, so were fed separately and given the medicated pellets as before, namely, those containing 2 gm. of phenothiazine per lb. This regimen was continued until January 19, 1956, a period of 22 days, when the test was terminated. During the

entire feeding period of 56 days, the older animals in the group consumed a total of 312 gm. of phenothiazine each, and the calves 224 gm. During the same period, the controls received alfalfa-grain pellets that contained no phenothiazine.

After the feeding program was started on November 25, 1955, the animals in both groups were examined for grubs at bi-weekly intervals. The grubs in the most prominent cysts in their backs were extracted at each examination and were examined for vitality and recorded. Some smaller grubs were likewise extracted, examined and recorded at the same time. Other grubs were left undisturbed to determine if continued feeding of the phenothiazine would eventually have some effect on them. A total of four bi-weekly examinations of the cattle were made during the grub season, the last of which was made on January 19, 1956. At this time, only a few young grubs were present in the backs of the cattle and these along with the remaining larger ones, were extracted.

Results

The results obtained in experiments A, B, and C are summarized in table I.

Discussion

In experiment A, the incidence of grub-infested cattle was 75% under daily administration of 2 gm. of phenothiazine for a period of 175 days. When the intake was 4 gm. per day, the incidence was 25%. All the four controls were infested. In Experiment B, which was conducted on a larger scale and under ranch feed lot conditions, no significant difference was observed between the animals fed phenothiazine and the controls fed plain feed. In this experiment, the cattle were given medicated feed for the usual feed lot conditioning period, 125 days, as compared to 175 days in experiment A. Experiment B was further complicated because the feed lot cattle that were administered a daily ration of pellets containing 4 gm. of phenothiazine, ate only slightly more than half the feed allotted to

TABLE 1. Data on Infestation of Grubs, *Hypoderma lineatum*, Observed in Cattle Treated Orally with Phenothiazine, Hexachloroethane, or Di-N-Butyltin Dilaurate, and in Comparable Control Cattle

Group	Treatment Administered per Animal	Total drug intake (gm.)	Cattle and Grub Infestations: Animals				Infestation	
			Number	Free	Infested	% Infested	Grubs	Average no. grubs per infested animal
	Experiment A: Pilot Tests							
	Daily Feeding during heel fly season of 1954							
I	Phenothiazine (2 gm. for 175 days)	350	4	1	3	75.0	9	3.00
II	Phenothiazine (4 gm. for 175 days)	700	4	3	1	25.0	16	16.00
	Six Monthly Drenches during heel fly season of 1954							
III	Phenothiazine (60 gm. per dose)	360	4	0	4	100.0	45	11.25
IV	Hexachloroethane (37 gm. per dose)	222	3	0	3	100.0	23	7.67
V	Di-n-butyltin dilaurate (50 gr. per dose)	19.4	4	0	4	100.0	41	10.25
VI	Controls	—	4	0	4	100.0	27	6.75
	Experiment B: Field Test							
	Daily Feeding during heel fly season of 1955							
I	Phenothiazine (2 gm. for 125 days)	250	27	1	26	96.3	485	18.65
II	Phenothiazine (2.6 gm. for 125 days)	325	10	0	10	100.0	244	24.40
III	Controls	—	34	1	33	97.0	867	26.27
	Experiment C: Field Test							
	Daily Feeding during cattle grub season 1955-56							
I	Phenothiazine: 4 gm. for 34 days 8 gm. for 22 days	312	12	1	11	91.7	145	13.18
	Phenothiazine: 4 gm. for 56 days	224	7*	0	7	100.0	103	14.71
II	Controls	—	21	0	21	100.0	291	13.86

*Calves in group I of Experiment C that would not eat more than 4 gm. of phenothiazine in their daily diet.

them, and therefore consumed only 2.6 gm. per day. Because of the difference in total amounts of phenothiazine consumed by the animals in experiments A and B, direct comparisons can not be made. However, the consumption of as much as 325 gm. of phenothiazine during the period of heel fly strike and early migration of the larvae did not reduce the number of infested cattle, or the number of grubs per infested animal in the ensuing grub season.

In experiment C, the administration of as much as 312 gm. of phenothiazine to range cattle during the grub season had no effect upon the vitality or development of grubs. Neither during nor at the conclusion of the 56-day feeding period was any difference observed in any of the grubs extracted from the treated animals as compared to those removed from the untreated controls.

Summary

Treatment by drenching infested cattle with phenothiazine, hexachloroethane, and di-n-butyltin dilaurate did not reduce the number of grubs per animal, nor the number of infested cattle. The daily treatment of a small number of cattle with from 2 to 4 gm. of phenothiazine incorporated into their feed appeared to reduce the incidence of infestation; however, when tested on a larger scale involving many more animals, no significant difference in the number of infested animals or the number of grubs per animal was observed in the treated animals as compared to the untreated controls.

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Brotherhood Week

Because one egg is bad is no reason to call the whole basket rotten. It's that way with people. We should judge our neighbors by the character of their lives alone and not on the basis of the group they belong to. A good week to start looking for the good eggs is BROTHERHOOD WEEK Feb. 17-24, 1957, sponsored by the National Conference of Christians and Jews.

"Myopathy in Sheep"

The relationship of so-called scarpie in sheep to degenerative diseases of the skin and muscles (dermatomyositis) and muscular dystrophy is discussed by Basanquet, *et al.* in *Lancet* for Oct. 13, 1956. The article describes a hitherto unrecorded spontaneous degeneration of skeletal muscle (myopathy) in adult sheep, which in many ways resembles the disease of dermatomyositis and muscular dystrophy in man. The term "myopathy" is used to mean a pathological degeneration of muscle of unknown cause.

Scapie and related diseases (myopathies) are widespread in Europe and are of considerable economic importance. The principal pathological lesions are degeneration of the skeletal muscles and often, the myocardium. Enlargement of adrenal glands is a regular finding; lymph nodes are occasionally increased in size. Skin lesions are commonly manifested as a rash with papular eruptions and subsequent alopecia. There is usually evidence of rubbing without external cause.

Six principal clinical syndromes of myopathy in sheep are described by the authors, two of which, hind limb palsy and pastpartum pining, have not been reported previously. Other syndromes are those of the disease known as scrapie.

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Role of Antibiotics in Animal Nutrition

In an address presented at the annual meeting of West Virginia feed dealers, Mr. W. M. Reynolds, assistant director of the Agricultural Research Center of Chas. Pfizer & Co., Inc., Terre Haute, Ind., stated that antibiotics fed at the nutritional level assisted in making possible an estimated $20,000,000. a year increase in the income of the nation's broiler industry. He also referred to feeds containing therapeutic levels of these agents as one of the most significant of recent animal feeding developments.

Constantly improved feeding is credited with the record for increased production of livestock. During the past 20 years egg production per hen increased 40%, poultry meat per 100 lb. feed doubled, and average milk production increased by 25%.

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Rabies in bats has been reported in 15 different states.

Mucosal Disease In Calves

I. A. SCHIPPER, M.S., D.V.M., and D. F. EVELETH, Ph.D., D.V.M., Fargo, North Dakota

SINCE 1952, various entities of the mucosal disease complex have been described.[1-19] In most instances, the susceptible age for cattle appeared to be eight to 20 months. In the past year extensive calf losses have been brought to our attention. These have occurred in range and housed cattle. In some instances, the entire calf crop has been lost or born dead.

Cases were brought to our attention usually as a result of extensive calf-crop losses. In most instances, the calves appeared normal when dropped but died 18 to 96 hours later. In some herds, abortions were frequent. Several histories of death occurring two weeks following birth are recorded. Herds involved were tested for brucellosis and leptospirosis and found free by titer of blood sera against respective antigens. Because symptomatology was similar to prevalent respiratory and enteric conditions of calves, most cases were treated accordingly by the owner or veterinarian servicing the herd.

Animals were brought to our laboratory when all reasonable chemotherapeutic approaches had failed and upon necropsy, pathology similar to mucosal disease was observed.

Histories of herds incurring extensive calf losses due to mucosal disease gave no indication of this entity having occurred or existing in any of the older animals except in one instance. The latter case was a three-year-old grade Shorthorn cow that exhibited typical mucosal disease. This animal was brought to our laboratory and held for observation. During three weeks of observation, condition began to improve. During the second week the animal calved. The calf died 24 hours later and upon necropsy typical pathology of mucosal disease was observed.

Symptomatology

Animals presented for diagnosis in some instances were full term dead calves. In one instance, a necropsy of a mature cow diagnosed as having mucosal disease possessed an 8½ month old fetus with typical lesions of mucosal disease. In most instances, the calves examined lived 18-96 hours following parturation. The newborn calf usually appeared normal at birth and nursed. The first symptom detected was a complete anorexia, elevated temperature, rapid dehydration and watery diarrhea. Depression, dyspnea, and an intermittent dry non-productive cough usually followed within four to eight hours. Prostration preceded death which usually occurred 18 to 96 hours following onset of symptomatology. Lacrimation was detected in several instances.

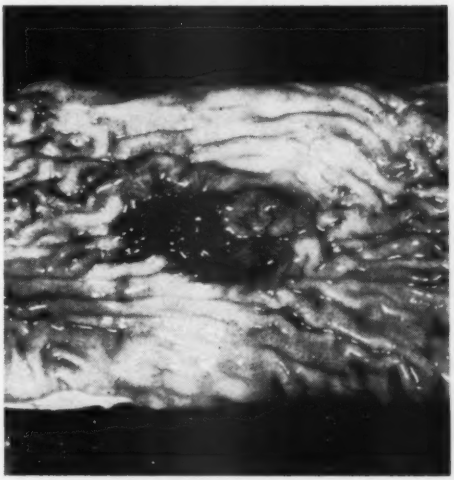


Fig. 1. Gross view of the ileocecal valve showing hemorrhage and necrosis.

Pathology

The nares and dental pads and conical papillae of the cheek exhibited edematous hyperemic areas varying from 2 mm. to 9 mm. in diameter. The nasal turbinates presented areas of necrosis 0.5 to 1 mm. in diameter and were usually covered with a brownish tenacious secretion. Hyperemia and congestion were evident. The frontal and nasal sinuses presented petechial and ecchymotic hemorrhages. An

Published with the approval of the director, North Dakota Agricultural Experiment Station, Fargo. Department of Veterinary Science. Mucosal Disease of Cattle, H-16-3R.

Fig. 2. Mucosal disease in a calf. Illustration multiple hemorrhage on the heart.

acute pharyngitis was usually present. Tracheal lesions varied from petechial to ecchymotic to "paint brush" type of hemorrhage extending throughout the entire trachea, but predominating in the anterior portions. Lungs usually appeared normal except for mild interstitial emphysema. The esophageal lesions consisted of necrotic areas 1 to 6 mm. in diameter which presented a punched out type of ulcer when mild pressure was applied. Rumenal lesions consisted of ecchymotic hemorrhages. A few petechial hemorrhages were observed in the omasum in several cases. The abomasum always exhibited numerous petechial and ecchymotic hemorrhages with frequent scattered areas of necrosis. The pyloric valve was always edematous and hyperemic. Usually an area of necrosis existed on the gastric side of the pyloric valve, particularly in older calves. In general, enteric lesions consisted of petechial hemorrhages, profuse necrosis and edema. The intestinal content consisted of a tenacious bile colored mucus. The ileocecal valve area was always edematous and hyperemic. Frequently an area of necrosis and hemorrhage was observed adajacent to the ileocecal valve. The terminal section of the cecum usually exhibited varying degrees of necrosis and hemorrhage. Grossly no hepatic pathology was observed. Gall bladders often presented small foci of necrosis and hemorrhage. The rectal portions of the intestine presented lesions typical of those formerly described for mucosal disease.

Experimental Investigation

Attempts were made to transmit the mucosal like condition of calves by several approaches.

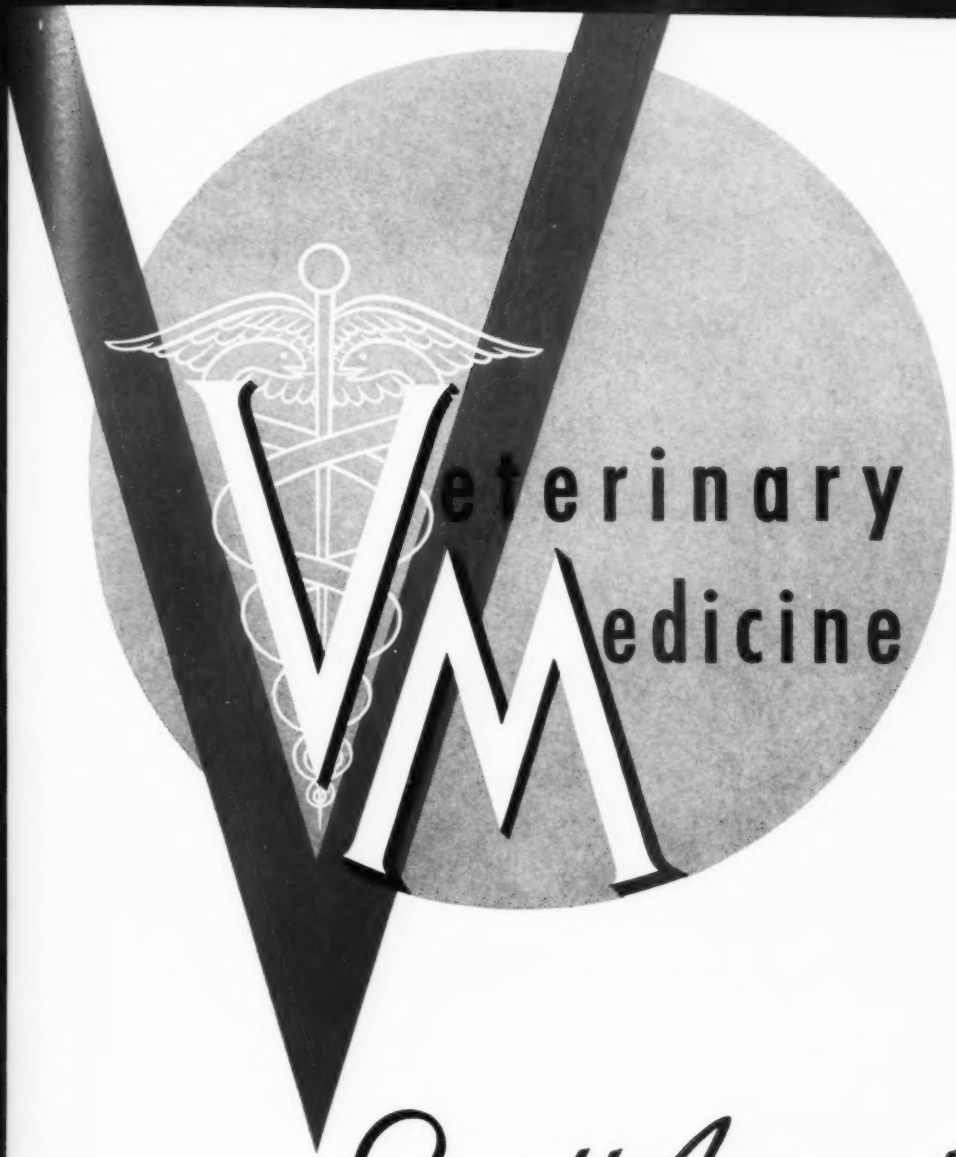
Milk Transmission. In two instances, the milk of the dames of the calves succumbing to the mucosal-like condition was given to healthy calves of a similar age. In one instance, the dam was presented with a nursing calf within eight hours following the death of her calf. The replacement calf nursed for three weeks. No typical symptomatology of mucosal disease was observed during the nursing period. Following two weeks of nursing, 10 cc. of whole blood of the nursing calf was administered to a healthy animal. During a three weeks postadministration observation, no symptomatology was observed in the recipient. The second calf received milk *via* pail feeding. Throughout 27 days of feeding, no symptomatology was observed. Necropsy revealed no pathology characteristic of mucosal disease.

Blood Transmission. Whole blood of two mucosal calves and one of their dams was administered intravenously to healthy calves in 10 cc. quantities. Calves receiving blood were under three weeks of age. All samples of blood were collected at the peak of temperature elevation of the donor. No symptomatology similar to that observed in mucosal calves was exhibited in the recipients up to four weeks observation.

Splenic Tissue Transmission. One healthy calf, two weeks of age, received 10 cc. of a splenic tissue emulsion intramuscularly. The emulsion consisted of one part of spleen and one part sterile saline by weight. The splenic tissue was obtained within one hour following death of a calf exhibiting typical pathology of mucosal disease upon necropsy. Three weeks following administration, the recipient exhibited no similar symptomatology of mucosal disease as observed under field conditions. No pathological lesions of mucosal disease were observed upon necropsy.

The experimental animals utilized in the above described experiments were from one herd. This herd has had no history of mucosal disease or contact with known mucosal diseased

(Continued on page 91)



Small Animal

SECTION

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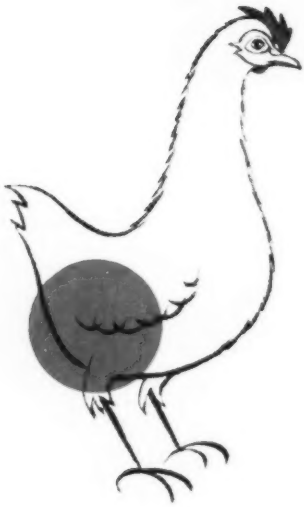

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A Reevaluation Of The Canine Filariasis Problem In The United States†

WALTER L. NEWTON,* Ph.D., and WILLARD H. WRIGHT,*
D.V.M., Ph.D., Bethesda, Maryland

THE recent discovery of the presence of a dog filariid other than the heartworm, *Dirofilaria immitis*, in the United States (Newton and Wright, 1956) has provided the stimulus for taking a more critical look at the general subject of canine filariasis in this country. It seems likely now that, in some instances, treatment, control measures, incidence surveys, host studies, and other biological studies which had been conducted with the assumption that a single filariid was present and the microfilariae in the peripheral blood of a dog were those of the heartworm may have led to erroneous conclusions and to some of the variation in published reports. The study mentioned above was conducted with the objectives of demonstrating that more than one filariid was present, and of making comparisons between them. Examination and discussion of some of the data obtained, together with some additional findings, can provide a more accurate and complete, if somewhat modified, concept of canine filariasis.

The microfilariae of the heartworm, *D. immitis*, obtained from the peripheral circulation averaged 313 microns in length (range: 307-322) and 6.9 microns in width (range: 6.7-7.1) when 1 ml. of blood was diluted with 10 ml. of 2% formalin. After such treatment, the microfilariae were quite straight and the tail terminated in a sharply-pointed, relatively straight line. In Giemsa-stained thick films, the four G-cells were arranged as follows: 1,——2, 3——4. In such films, the microfilariae assumed variously sinuous positions, but were rarely tightly coiled upon themselves. In periodicity studies around the clock on two dogs with this parasite, the microfilarial concentration in the peripheral blood was higher at night than in the day, although not markedly so.

Insect Vectors

Intermediate host studies indicated that dog and cat fleas could hardly serve as vectors of *D. immitis* inasmuch as the parasite failed to develop beyond the microfilarial or very early first stage in these insects. On the other hand, development of *D. immitis* larvae to the infective stage occurred quite regularly in the Malpighian tubules of the mosquito, *Anopheles quadrimaculatus*. The latter would seem to offer considerable potential as a vector. While such findings have been reported before, it has not always been certain that heartworm was the filariid (and the only one) present in the dogs used as the source of microfilariae. Conflicting results have often been obtained in studies on the susceptibility of the flea, for the same reason.

*U. S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, National Institute of Allergy and Infectious Diseases, Laboratory of Tropical Diseases.

†Based on material presented at the 27th annual meeting of the Florida State Veterinary Association, Pensacola, Sept. 23-25, 1956.

Much has been written about the adult heartworm, for many cases of infection have been observed, especially by veterinarians in our southern states. Hence, except for comparative purposes, little need be said about this parasite here. *D. immitis* is a relatively large species, measuring some 25-30 cm. in the case of the female, and 15 to 20 cm. in the case of the male. Its usual location is the right ventricle and pulmonary artery, wherein it apparently remains and may occur in surprisingly large numbers. The pathological potential of this parasite is somewhat apparent from its size, location, and the number of worms which can accumulate there. Most veterinarians in endemic areas are well acquainted with the disease in cases of heavy infection.

The newly-found filariid belongs to the genus, Dipetalonema, and while the adult compares favorably with the *D. reconditum* described in Grassi and Calandruccio (1890) and redescribed by Noe (1907), there are a few anatomical differences the importance of which have not yet been fully assessed. The microfilariae of this nematode proved to be significantly smaller when handled exactly as was indicated for heartworm microfilariae. The average length of those recovered from peripheral blood was 276 microns (range: 269-283), and the average width was 4.6 microns (range: 4.3-4.8). The tail, also sharply pointed, was longer in comparison with overall size than that of the heartworm microfilariae, and in formalin solution ended regularly in a curved buttonhook fashion which may prove to be quite diagnostic—at least for the purpose of distinguishing it from the heartworm. In Giemsa-stained blood smears, the G-cell pattern was different from that of *D. immitis* microfilariae, as follows: 1,——2, 3, 4. In such blood films, the microfilariae were frequently arranged in tight coils. Periodicity studies were not too satisfactory, but the peak in microfilarial counts occurred in the daytime rather than at night, as was the case with the heartworm microfilariae.

Intermediate Hosts

In intermediate hosts studies, results were the opposite of those obtained with the heartworm. No development occurred in *A. quadrimaculatus,* whereas in fleas the parasite regularly attained the infective stage in less than two weeks. Both *Ctenophalides canis* and *felis* were suitable hosts, with development taking place in the cells of the fat body. It is to be wondered whether the developing "heartworm" larvae observed in fleas many times in the past were not larvae of this species of Dipetalonema.

The few adults observed in a dog for the first time in this country, as far as is known, were about 1/10th the size of heartworms. (See figure 1.) The female averaged approximately 31.5 mm. in length, and 180 microns in width at the widest area. The single male recovered was rather twisted and had several caudal loops; however, upon careful stretching it measured about 17 mm. in length and 106 microns in width. The adults occurred in the

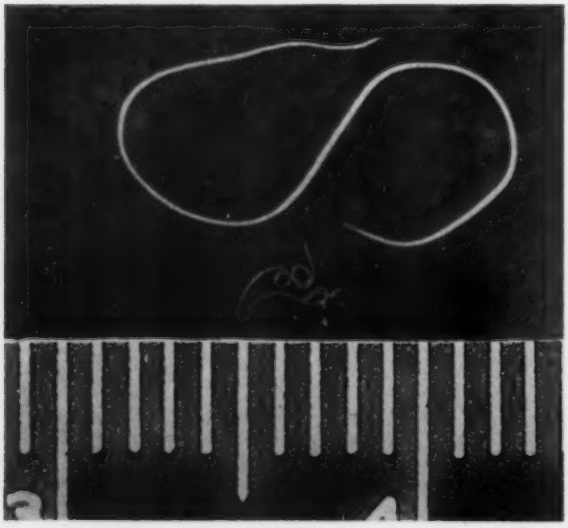

Fig. 1. *Dipetalonema sp. (reconditum?)* recovered from subcutaneous tissue of dog. The larger is a female; the smallest unit of the rule is 1 mm.

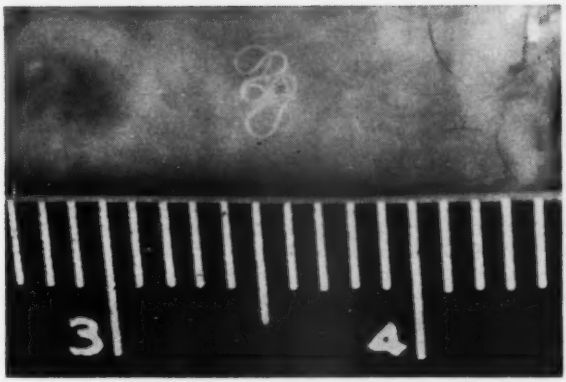

Fig. 2. *Dipetalonema sp. (reconditum?)* fixed *in situ* under skin of dog. The smallest unit of the rule is 1 mm.

subcutaneous areas, one being found immediately under the skin and others scattered at several different levels in the connective tissues. They appeared to move slowly, but without apparent difficulty or obstruction. There was no obvious gross pathology.

Thus, we see that the canine filariasis problem in this country actually includes at least two species instead of the one, *D. immitis*. Of what significance is this to the practicing veterinarian? Certainly the discovery of the Dipetalonema species would not seem to require any immediate change in the handling or treatment of demonstrated heartworm cases. The main point would seem to be one of differential diagnosis. With the heavy metal preparations and the surgery that are being used as therapy, one would probably wish to be certain that the infection under treatment was heartworm and not some small, perhaps relatively innocuous, subcutaneous filariid. Presumably, the history and symptomatology of an animal is also evaluated before any such potentially rigorous treatment is undertaken. However, these can at times be misleading, and the identification of the microfilariae is a certain way of demonstrating that a particular filariid is, or was, present.

Until it is determined whether the Dipetalonema has some deleterious effects on the host, the heartworm will probably remain the dog filariid of clinical importance. Nonetheless, information on the pathogenicity of the former obviouly should be obtained. Perhaps, in their wanderings, these parasites may get into vital areas and cause damage. Or, perhaps chemotherapeutic agents used against heartworm may result in confusing symptoms and reactions if they affect either the microfilariae or adults of a concomitant Dipetalonema infection. That mixed infections will occur can be expected, and this was demonstrated recently. We were sent a formalinized blood sample taken from a dog from Alabama considered by the veterinarian, who had read our report, to harbor two kinds of microfilariae. Examination revealed the presence of both the heartworm and the Dipetalonema microfilariae. Interestingly enough

TABLE 1. A Comparison of the Morphology and other Characteristics of *Dirofilaria immitis* and *Dipetalonema sp. (reconditum?)* Recovered from Dogs in the United States

Characteristic	*D. immitis*	*Dipetalonema sp.*
Microfilaria		
Size in 2% formalin — Length	307-322 microns	269-283 microns
Size in 2% formalin — Width	6.7-7.1 microns	4.3-4.8 microns
Tail in 2% formalin	Mostly straight	Curved, like buttonhook
G-cell pattern, Giemsa-stain smear	1,———2,3———4	1,———2,3,4
Development in fleas	None	Complete
Development in *Anopheles quadrimaculatus*	Complete	None
Adults		
Female length	25-30 cm.	3.0-3.2 cm.
Male length	15-20 cm.	1.7 cm.
Location	Right ventricle and pulmonary artery	Subcutaneous areas throughout body

practically all of the latter showed the characteristic buttonhook tail, and could be rather easily distinguished from the microfilariae of *D. immitis.*

We also need information on the incidence and distribution of the two filariids. It is to be recalled from our report (Newton and Wright, 1956) that of seven microfilariae-positive dogs obtained at Norfolk, Va., four had heartworm infection and three had the species of Dipetalonema. Also, it has been our experience with over 250 dogs from the general area of Pennsylvania, Maryland, and New Jersey, that of 18 positives, only three contained heartworm microfilariae; the rest were infected with the Dipetalonema. Thus, it would seem that the latter may be the common filariid of dogs in the northern United States, and that heartworm may be of relatively infrequent occurrence there. In the southern states, on the other hand, both kinds are probably prevalent, with perhaps the heartworm the more frequent. Incidence studies will, of course, determine this. However, the vectors involved stimulate such speculation. If the Dipetalonema is transmitted by dog and cat fleas, one might expect a more or less even distribution in incidence from north to south, on the assumption that the fleas are not so susceptible to climatic conditions and are able to transmit infection year around. In contrast, a parasite that uses a mosquito as its vector (particularly if an anopheline is the important host) might be expected to be somewhat restricted to, or more prevalent in, the areas that, because of the warmer climate, have a longer breeding season.

In connection with incidence surveys, or an individual diagnosis, it is well to keep in mind the possibility that microfilariae other than those of either heartworm or the Dipetalonema may also be encountered. For example, there is another tissue filariid of dogs, *Dirofilaria repens,* which has been found in other countries, and concerning which there is information in most texts on animal parasites. It would not be too surprising, now that we are thinking in this direction, if someone were to report its presence in this country.

Summary

By way of summary, these findings can be resolved into two obvious points of interest and concern to the practicing veterinarian: He must now take into consideration the fact that the presence of microfilariae in the blood of a dog does not necessarily indicate heartworm infection. Secondly, effort should be made to distinguish the various filariid infections, primarily for the purpose of determining the presence of the, probably, clinically more important parasite, the heartworm. The data that we have obtained thus far in a comparison of *D. immitis* with the subcutaneous filariid, *Dipetalonema sp.,* are presented in table 1, and should be of considerable assistance in making the distinction between them.

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Carcinogenesis

The *Journal of the American Medical Association* (Dec. 1, 1956, page 1318) summarized information regarding the significance of viruses as etiological factors in the development of malignancies in animals, and as these may bear on the relationship to comparable conditions in man. It is mentioned that various forms of leukemia and sarcoma in chickens have been found to be transmitted by filtered extracts. That lymphomatosis ("range paralysis") in chickens in some instances may be air-borne, and that this epornitic has been established by passage through embryonated eggs. A certain form of breast carcinoma in mice has been found to be transmitted by the milk from healthy carrier mothers, and mouse leukemia has been demonstrated to be due to a filterable virus. In human beings warts and papillomas have up to this time been demonstrated to be transmitted by filtered extracts. It is theorized that "these viruses may be transmitted from generation to generation, remaining in a latent form harmless to their carrier hosts" until, "prompted by some obscure activating factors." A question of importance that still remains unanswered is whether these oncogenic agents are single viruses, or a mixture of closely related viruses. By means of the electron microscope the virus of mouse leukemia is seen to be "a spherical particle 70 millimicrons in diameter," and for chicken leukemia the spherical particles — there seem to be two indistinguishable ones— the size is approximately 120 millimicrons. The editorially abstracted material in this A.M.A. presentation is well worth the perusal in its entirety by veterinarians. References are cited.

Aseptic Veterinary Surgery: Fact And Fancy†

W. W. ARMISTEAD,* D.V.M., Ph.D., College Station, Texas

TO begin with, it is doubtful that absolute asepsis ever is achieved and maintained throughout an extensive surgical procedure, either human or veterinary. Asepsis is the laudable aim of the best surgical technic but in practice is never fully attained. As a result, surgical asepsis as we know it is a *relative* state — an attempt as nearly as possible to approach bacteriologically sterile conditions. How nearly the surgeon approaches asepsis is important to the outcome of the operation. If he gets close enough, the patient's body defenses may be able to complete the job; if he falls too far short, these defenses may be overwhelmed and postoperative infection may result. How far short the surgeon may safely fall depends on a number of factors.

Capacity of the Tissue Involved to Resist Infection. Even in health the various tissues of the body exhibit striking differences in their defensive capacity against infection. For example, muscle more readily resists infection than does subcutaneous connective tissue or fat; peritoneum appears to be more resistant than is bone. In the case of systemic illness or unusual stress, all tissues become less resistant. Trauma also greatly increases the likelihood of local infection and this fact is a good argument for gentleness in surgery.

Kinds of Microorganisms Present. Some microorganisms are highly pathogenic, some are moderately pathogenic, some are pathogenic only under certain conditions (opportunists), and still others are nonpathogenic. The surgeon can not know which are present and, consequently, he must attempt to remove them all.

Degree of Contamination. The patient may be able to overcome a few highly pathogenic bacteria but succumb to an overwhelming number of opportunists. Preoperative scrubbing and disinfection can prevent massive contamination even though it does not produce absolute sterility of the operative site.

The whole matter of preoperative skin preparation has been misunderstood by surgeons for years. Most human surgeons, believing that living skin can not be sterilized, have insisted that it be treated throughout the operation as if it were dangerously contaminated. "Best" technic dictates that, after incising the skin, the scalpel be discarded and the edges of the skin incision covered with sterile drapes. A new sterile scalpel then is used to continue the incision into the deeper tissues. The theory behind these recommendations has been that, even after careful scrubbing, dangerous microorganisms lurk in the depths of hair follicles and skin glands and these can be carried into the deeper parts of the incision if the same scalpel is used, or if skin edges exposed by the incision are not immediately covered. The facts do not support such a theory.

There are two kinds of bacteria on the skin of animals. Transient bacteria are those which are picked up from day to day from the environment. Although they may be pathogenic, they vary in types and numbers, they are loosely attached, and are easily removed by careful scrubbing. Resident bacteria are those which live in the deeper layers of the skin and in hair follicles and sebaceous glands. Although not so easily removed, resident bacteria are usually nonpathogenic species which have become adapted to the host and elicit little or no tissue reaction. That all the transient bacteria and most if not all the resident bacteria can be removed by proper scrubbing has been shown by studies conducted at the A. & M. College of Texas.[1]

In these studies skin areas on 40 animals were prepared by the following method. After shaving, the skin was carefully scrubbed, rinsed, and dried. In the dogs and cats, pHisoHex®[1] was used; in the horses, calves, goats, and pigs, liquid soap was used. Each site was then

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†Presented at the 27th Annual Meeting of the Florida State Veterinary Medical Association, Pensacola, Sept. 23-25, 1956.

*Dean, School of Veterinary Medicine, Texas A. and M. College.

®[1]pHhisoHex is Winthrop Laboratories' trade name for a cream detergent and antiseptic containing sodium octylphenoxyethoxyethyl sulfonate, lanolin cholesterol, and petrolatum (pHisoderm); and bis-(2-hydroxy-3,5,6-trichlorophenyl) methane (hexachlorophene).

alternately with 1:1000 roccal®[8] solution then 70% alcohol — a minimum of four times each, using sterile gauze sponges. Squares of this skin then were transplanted to sites within the peritoneal sacs of these animals. After varying intervals up to six months animals were sacrificed and the buried grafts were examined both grossly and microscopically. In 80 such grafts examined no evidence of infection was found in spite of the fact that no antibiotics or bacteriostatics were administered to the animals before, during, or after the surgery.

In 24 cases, bacteriologic studies were made, at the time of operation, of bits of the same skin removed for transplantation. In most instances, the skin cultures were bacteriologically sterile; in the others, only nonpathogens were found and these in small numbers. Details of these bacteriologic studies have been reported previously.[8]

Thus it appears that proper preoperative preparation can render skin for practical purposes sterile; any bacteria remaining are likely to be nonpathogens which will cause no infection. This is true not only for small animals but for large, farm animals as well if contamination from the environment during operation can be controlled. Practical evidence that skin can be rendered bacteriologically innocuous is the long successful use of the through-and-through suture in abdominal surgery. Also in support of this proposition is the fact that metal pins can be driven through the skin and into bone for fracture fixation — this in spite of the fact that the defensive ability of bone against infection is less than that of more vascular tissues. Naturally no technic, either in human or veterinary surgery, can absolutely prevent contamination of the operative site by microorganisms which are in the air of the surgical theater. We must depend on postoperative treatment and the patient's body defenses to take care of these.

Intraperitoneal Surgery in Horses. There are other commonly held beliefs that have been proved false in recent years. One of these is that abdominal surgery in the horse is too hazardous because the horse is much more susceptible to peritonitis than are other species. Actually, intraperitoneal surgery can be successfully done in the horse — even without the use of modern antibiotics and bacteriostatics, if the elements of aseptic surgical technic are followed.[8]

®[8]Roccal is Winthrop-Laboratories' trade name for a mixture of high molecular crude alkyl-dimethyl-benzyl-ammonium chlorides.

Postoperative Peritonitis. Most veterinary surgeons have had the experience of an abdominal surgery patient succumbing to peritonitis several days to a week or so following operation. Frequently bacterial contamination during the operation is blamed — particularly if the operation was one for pyometra, dystocia, or intestinal perforation. As a matter of fact, even massive contamination of the peritoneal sac, as in the case of accidental incision of a pus-filled uterus, can be overcome if the repair is well done, the peritoneal sac carefully flushed, and postoperative antibiotic therapy administered. Fatal peritonitis is much more likely to result from continuing contamination, as from a leaky anastomosis, faulty closure of a uterine stump, or cutting through of a ligature into the contaminated lumen of an intra-abdominal organ.[4,5,9] Naturally the likelihood of peritonitis developing always is enhanced by excessive mechanical trauma to the peritoneum.

Postoperative Wound Infection. It is easier for the surgeon to believe that wounds which begin to suppurate became infected after, rather than during, the operation. Postoperative contamination due to problems of restraint and sanitary housing often are given as the principal reasons why postoperative wound infection is more common in veterinary than in human surgery. However, there would seem to be some doubt that this is the case. If (1) the operation is as aseptic as possible, (2) the tissues are not excessively traumatized, and (3) edges of the wound are aligned and kept stationary by proper suturing and splinting if necessary, then the entrance of infecting organisms after operation is unlikely. The success that many veterinarians have with unbandaged surgical wounds is a tribute to their technic. The seeping surgical wound usually is one in which tissues were excessively traumatized, hemorrhage was incompletely controlled, or circulation was strangled. Such wounds are fertile culture media for bacteria introduced either during or after the operation. Bandaging the seeping wound actually may increase the likelihood of infection by plastering exudates against the wound and preventing drying (sealing). Bandages serve best to prevent postoperative damage to the dry wounds which result from aseptic, atraumatic surgery.

Strength of Suture Materials. An idea which is slow to die in veterinary surgery is that the strength of a wound closure can be increased by using larger gauge suture material. The

(Continued on page 87)

Antirabies Vaccination Of Man With HEP Flury Virus†

JOHN P. FOX,* M.D., DONALD P. CONWELL,*M.D., and PHYLLIS GERHARDT,* New Orleans, Louisiana

THE Flury strain of rabies virus was isolated from man by Johnson and was established by him in serial brain-to-brain passage in day-old chicks. In 1948, Koprowski and Cox[1] reported its adaptation to the chick embryo with further attenuation on continued passage. Living Flury virus from about the 50th embryo passage is now widely employed for canine immunization. Between the 176th and 182nd egg-passage levels the strain lost its ability to cause fatal disease when injected intracerebrally in adult mice.[2] Because of its minimal virulence for laboratory animals, this high egg passage (HEP) virus was chosen for experimental immunization of man.

Our first and continuing interest lay in the possible use of HEP Flury virus for postexposure immunization of man against rabies. Current Pasteur treatment not only fails to reliably protect persons subjected to severe exposure who may develop disease after a short incubation period but is fraught with the hazard of serious demyelinating reactions.[3,4] Use of the newly available hyperimmune sera should protect patients against rapidly developing disease[5,6] but some form of active immunization is necessary to accompany the serum and also for those less severely exposed for whom serum is not indicated. To avoid the tissue-specific sensitization postulated as the cause of the demyelinating reactions, one might employ a vaccine free of central nervous system (CNS) tissue such as HEP Flury virus vaccine.

Our initial experiments, reported in Rome in 1953,[7] were limited to the use of large intramuscular inocula (2 gm. of chick embryo). The results indicated that, with the inoculation schedules employed, both the frequency and degree of response were related to the total mass of infected embryo tissue inoculated. Theoretically, this has been interpreted to mean that HEP Flury virus, although living, does not multiply in man when inoculated extraneurally, and, hence, the total stimulus must

*Division of Epidemiology, Department of Tropical Medicine and Public Health, Tulane University School of Medicine.

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Presented before the American Association of Immunologists on April 19, 1956 at the meeting in Atlantic City, N. J., of the Federation of American Societies for Experimental Biology.

Reprinted from the November, 1956 issue of the Bulletin of the Tulane Medical Faculty (vol. 14, no. 10).

Presented at the 27th annual meeting of the Florida State Veterinary Medical Association, Pensacola, Sept. 23-25, 1956.

TABLE 1. Appearance of Antirabies Neutralizing Antibody after large Intramuscular Inocula (2 gm.) of Chick Embryo Tissue Infected with HEP Flury Virus

Inoculation data				Number persons with antibody[1] on indicated day after first inoculation						
Total dose (gm.)	No. doses[2]	Interval (days)	Total no. persons	0	10	15	20	30	60	% responding overall[3]
2	1	—	12	0	—	0	—	2	2	17
4	2	3	14	0	—	0	—	6	6	43
—	—	10-20	18	0	—	7	10	10	10	55
—	—	30	6	0	—	—	—	2	6	100
6-8	3-4	1 or 3	42	0	9	12	13	17	17	48
12	2-6	1-7	14	0	7	8	8	9	12	93
20	5-10	1-2	10	0	7	7	7	8	9	100

[1]Antibody as indicated by survival of three or more of six mice inoculated with mixture of 1:4 final dilution of serum and 100 ld_{50} of virus.

[2]In certain groups a dose consisted of two or more inocula given in as many sites.

[3]Discrepancy between overall per cent responding and per cent with antibody in 60-day sera results from fact that antibody detectable in some persons before 60 days had fallen below detectable level by 60 days.

be derived from that antigen actually inoculated. Practically, excessive amounts of embryo tissue (total doses of 12 to 20 gm.) were found necessary to insure uniformity of response. Since practical methods for materially increasing the concentration of viral antigen in the vaccine have not yet been discovered, our subsequent work has been directed towards utilizing the available antigen more efficiently by better selection of route and intervals of inoculation. The present report deals both with new observations as to primary immunization and with the use of HEP Flury virus for restimulation of previously established immunity.

Methods and Materials

The HEP Flury virus vaccine consists of homogenized, infected chick embryo material dehydrated to 40 to 67% concentration from the lyophilized state and it was furnished through the courtesy of Dr. Hilary Koprowski of Lederle Laboratories. The Harris and Semple vaccines employed for comparative purposes were commercially available products.

The human participants were inmates of the Louisiana or Mississippi State Prisons who volunteered freely with neither coercion nor proferred inducement and to whom we are deeply indebted. These volunteers were carefully observed for possible reactions for 21 days after inoculation.

In all cases, response to immunization was judged on serologic grounds. Sera taken before and at intervals after inoculation were tested for the presence of neutralizing antibody. For screening purposes, sera were tested in 1:4 final dilution against 100 ld_{50} of a standard strain of fixed rabies virus, using six mice per serum-virus mixture. In titrations, serial two-fold dilutions of serum were similarly tested.

Results

The problem of primary safety can be disposed of quickly. To date nearly 300 volunteers have received primary courses of HEP Flury virus vaccine consisting of one or more inoculations. Two instances of immediate anaphylactoid reactions were observed following large intramuscular inocula. The only other reactions have been the moderate local tenderness or small persisting nodules that might be expected following intramuscular or intradermal inocula. There have been no reactions attributable to the Flury virus itself. Also, more than 60 men have been given booster inocula at intervals of from five to 30 months after primary immunization without evidence of sensitization to the embryo tissue.

Initial interest in serologic response centers about the time and uniformity of appearance of antibody. Table 1 summarizes such observations with respect to courses involving large intramuscular inocula and includes both old and new data. Three points of interest are evident. First, if one considers only the courses involving closely spaced inocula, there is the already mentioned direct relation between total amount of embyro material inoculated and overall per cent of response; from 17% after

TABLE 2. Appearance of Antirabies Neutralizing Antibody after small Intramuscular (0.33 gm.) or Intradermal (.04 to .08 gm.) Inocula of Chick Embryo Tissue Infected with HEP Flury Virus

Total dose (gm.)	Route	No. of doses[2]	Interval (days)	Total no. of persons	Number of persons with antibody[1] on indicated day after first inoculation						% responding overall[3]
					0	10	15	20	30	60	
.04	ID or IM	1	—	7	0	0	0	0	0	0	0
.08-.16	ID	2	5-10	23	0	2	6	7	11	4/15*	52
.12-.48	ID	3	5	16	0	6	10	11	12	11	88
.16-.64	ID	4	5	19	0	8	14	16	18	18	95
.64	ID	4	5	11	0	1	3	4	4	3	54#
.24-.32	ID	6-8	2-3	15	0	1	5	9	10	¾*	67
.64+2.64	ID+IM	4	5	8	0	5	7	7	8	8	100
.66	IM	2	10-15	8	0	—	2	2	2	3	37
—	—	—	30	4	0	—	—	—	1	3	75
.99-2.64	IM	3-4	5	18	0	5	9	10	12	13	78
2.64	IM	8	2	4	0	3	4	4	4	4	100

[1,2,3]As in table 1.

*In certain instances 60 day sera were not tested or could be obtained; ratio of number positive/number tested is shown.

#This group of 11 persons received vaccine of low titer (about 3.5 logs).

TABLE 3. Appearance of Antirabies Neutralizing Antibody After Subcutaneous Inocula of Harris or Semple Type Vaccine

Type of vaccine	Inoculation data: No. of doses	Inoculation data: Interval (days)	Total no. of persons	Number of persons with antibody on indicated day after first inoculation: 0	10	15	20	30	60	% responding overall
Harris	14	Daily	9	0	2	9	9	9	9	100
Semple	14*	Daily	10	0	2	8	9	9	9	90
—	2	10-15	16	0	1	13	14	15	14	94
—	4	5	19	0	6	17	19	19	19	100

*Sera of these ten persons obtained through courtesy of Dr. M. M. Kaplan, Veterinary Public Health Section, World Health Organization.

2 gm. to 100% after 20 gm. Second, if one considers the courses involving two inocula with a total dose of 4 gm., there is an indication of the importance of spacing the inocula; the longer the interval, the greater the proportion responding. Unfortunately, the 30-day interval, associated with 100% response, is too long for purposes of emergency immunization. Finally, one may note the appearance of antibody in many persons as early as ten days after initiation of the more massive courses.

The more recent work has centered about courses of smaller inocula consisting either of 0.33 gm. per intramuscular site or .04 to .08 gm. per intradermal site. Multiple sites occasionally were inoculated simultaneously. The results of this work, in terms of time and uniformity of antibody appearance, are summarized in table 2. It is at once apparent that a single small inoculum (0.04 gm.) was without evident effect. Also, unsatisfactory response was elicited by two inocula given by either route and separated by no more than 15 days. It is interesting, however, that two small intradermal inocula are apparently more effective than two significantly larger inocula given intramuscularly. At the other extreme, six to eight doses with intervals of two to three days were tried. Such a combination given intramuscularly to four men yielded encouraging results but obviously has not been adequately tried; given intradermally the results were less satisfactory with only 67% overall response. Of the combinations more adequately tested, those involving three or four doses with a five-day interval were most promising, with the intradermal route proving somewhat more effective (of 19 men given four doses, all but one responded). An exception to this statement appears in the next line of the table; of 11 men given four doses, each consisting of .04 gm. inocula in four different sites, only six responded. This group illustrates the importance of using maximally potent vaccine; inadvertently, it received material from a lot with a low titer (3.5 logs instead of 5.0 or better). Finally, the most promising group of all — on the basis of still rather inadequate results — is that of eight men inoculated by both routes on four occasions.

For comparative purposes the serologic response to conventional vaccines was studied similarly. The results are shown in table 3. These commercially available vaccines apparently are more potent antigenically than the HEP Flury vaccine. While the conventional 14-dose course does a gratifyingly uniform job of eliciting seroimmune response, it is of special interest to see what fewer, more widely spaced doses will do. As few as two inocula did nearly as well as the more promising courses of Flury vaccine, while four inocula with the five-day interval seem to have done fully as well as 14 daily doses.

Data with respect to antibody levels following primary immunization are still incomplete. The available results for sera taken 15, 30 and 60 days after the start of immunization are summarized in table 4. Although the titer ranges overlap somewhat, it is evident that Harris or Semple vaccine stimulates higher titers of antibody than does HEP Flury vaccine in any course so far employed. First is the fact that four doses of Semple vaccine did as well as 14 doses of Harris vaccine. And second, although the numbers are small, four intradermal doses of HEP Flury virus yielded somewhat higher titers than did three intradermal doses or any of the larger amounts of vaccine given intramuscularly.

One feature of primary emergency immunization not so far stressed is rapidity of response. In this important respect, at least, HEP Flury vaccine apparently more than held its own. Of 37 persons who ultimately responded to four or 14 doses of Semple or Harris vaccine, ten (or 27%) had antibody demonstrable by the tenth day. The corre-

sponding figure for 88 persons who ultimately responded to the more satisfactory courses of HEP Flury vaccine was 42 (or 48%). This suggests that, when Flury virus did elicit a response, it did so more rapidly than did conventional vaccines.

We have also made some observations as to the ability of HEP Flury virus to restimulate seroimmune response in previously immunized persons. The available data are presented in table 5. Fifty-four persons had received a primary course of HEP Flury vaccine five to 24 months previously. This group included 24 classed as not responding to primary immunization and seven whose response was dubious. Many of these had received only one or two inocula. Response to the Flury virus booster was not related to dose or route; the small .04 gm. intradermal inoculum was apparently as effective as 2 gm. given intramuscularly. Only four of the 54 failed to respond and all four were individuals who had shown no response to a one-dose primary course. Finally, there are two groups of persons who gave a history of previous Pasteur treatment. The first group consists of 15 persons whose booster inoculum was given intramuscularly. Since most of this group were prisoner volunteers, it was not possible to verify their history. In any event, it is of interest that eight of these, including six with treatment within the previous 20 years, responded. The second group of 20 is made up chiefly of veterinarians whose history is considered more reliable. Of these, 18 responded including all whose last previous treatment was within the past 20 years. Of special interest in this group is one person, a laboratory worker, definitely treated 40 years previously, who gave a clear-cut booster response. Titrations of postbooster sera are still incomplete but the considerable number tested have yielded titers ranging up to 1:1024 with few below 1:32 by the 15th day.

Discussion and Summary

We had shown previously that HEP Flury vaccine employed in undesirably large total doses would stimulate readily demonstrable neutralizing antibody with reasonable uniformity. We have now shown that much smaller doses, properly spaced are about equally effective. Specifically, vaccine of near maximal potency given intradermally three or four times at five-day intervals elicited response in over 90% of 35 recipients and with gratifying rapidity in many but not all of those responding. However, when compared with the four or 14 dose schedule of conventional vaccines, the most adequately tested primary courses of

TABLE 4. Distribution of Sera Collected at Intervals after Primary Immunization against Rabies by Titer of Neutralizing Antibody

Inoculation data				Total no. of persons	Days after first inoculum	Number of persons with antibody titer in indicated dilution range of 1:x					
Type of vaccine	Route	No. of inocula	Interval (days)			<4	4-7	8-31	32-127	128-511	512+
Harris	SC	14	Daily	9	15	—	—	2	4	3	—
				9	30	—	—	—	2	3	4
				9	60	—	—	—	4	5	—
Semple	SC	2	10	9	15	1	1	1	5	1	—
				8	30	1	—	2	4	1	—
				6	60	1	—	4	1	—	—
Semple	SC	4	5	18	15	2	—	—	7	8	1
				18	30	—	—	1	3	10	4
				18	60	—	—	1	8	8	1
Flury (12-20 gm. total)	IM large	2-10	1-7	20	15	9	1	5	5	—	—
				20	30	4	1	8	7	—	—
				20	60	1	1	9	9	—	—
Flury (2.6 gm. total)	IM medium	4	5	8	15	3	2	3	—	—	—
				7	30	1	—	4	1	1	—
				8	60	1	2	3	2	—	—
Flury	ID	3	5	8	15	3	1	4	—	—	—
				8	30	2	1	1	4	—	—
				8	60	2	1	2	3	—	—
Flury	ID	4	5	8	15	3	1	3	1	—	—
				8	30	1	1	3	2	1	—
				7	60	1	—	—	3	3	—

Flury vaccine were found wanting in terms of both uniformity and level of antibody response.

One may ask at this point what constitutes an adequate response to emergency primary immunization. Results with the booster inocula indicate that many of those classed as not responding to a primary course of Flury vaccine (20 of 24 tested) were nonetheless immunologically altered or conditioned. Also, using a method involving long incubation of the serum-virus mixture in the cold, Doctor Koprowski demonstrated significant neutralizing antibody in many of the same postvaccination sera which we found negative.[2] Specifically, these included all sera tested coming from persons receiving two or more doses of Flury vaccine and they also included sera from the 20 persons who failed to respond initially but later responded to the booster. Of equal interest, among those he found negative were the sera from the four persons who failed to respond to the booster. Thus, a primary course of Flury vaccine consisting of two or more doses apparently can be relied upon to induce antibodies detectable by the "long incubation" technic and to condition the recipient for a later booster inoculum. Conceivably, this may be enough to protect him against rabies.

Whether or not primary immunization with Flury vaccine is adequate for the postexposure emergency, the experience with booster-inocula suggests that it can be used effectively to initiate and maintain nonemergency immunization in high risk groups such as veterinarians, postmen and dog catchers and, perhaps, even in the general child populations of areas where rabies is highly endemic. More data are needed, of course, as to optimum spacing of boosters but it might well be used much as tetanus toxoid with routine reinforcement every three or four years and an additional inoculum on the occasion of suspected exposure. Since persons being subjected to a second course of Pasteur treatment are at special risk of treatment reactions, another field of potential application is in the emergency renewal of immunity in such individuals. The pertinent data here presented are scant but an extensive study among veterinarians is now underway to establish the reliability of the booster with reference to time elapsed since Pasteur treatment.

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(Continued on page 90)

TABLE 5. Response to Use of HEP Flury Virus as a Booster Inoculum in Persons with Prior Antirabies Immunization

Primary course—type of vaccine	Interval since primary	HEP Flury booster inoculum	Response to primary course	Number of persons	Persons responding to booster	
					Number	Per cent
HEP Flury virus	5-24 mo.	2.0 gm. IM	No	14	11	79
			Yes	7	7	100
		0.33 gm. IM	No	3	3	100
			Yes	8	8	100
		0.04 gm. ID	No	7	6	86
			Dubious*	7	7	100
			Yes	8	8	100
		All	No	24	20	83
			Dubious*	7	7	100
			Yes	23	23	100
Conventional Pasteur Treatment	2-7 yr.	.33 or 2.0 gm. IM#	Unknown	4	3	75
	10-19 yr.		Unknown	4	3	75
	20-19 yr.		Unknown	3	0	0
	Unknown		Unknown	4	2	50
	1-4 yr.	.08 to .16 ID gm.	Unknown	4	4	100
	5-9 yr.		Unknown	4	4	100
	10-19 yr.		Unknown	3	3	100
	20-29 yr.		Unknown	4	2	50
	40 yr.		Unknown	1	1	—
	Unknown		Unknown	4	4	100

*Mouse survival rations of 1/6 or 2/6 observed in screen tests of one or more post-vaccination sera.

#Most of this group were prisoner volunteers whose story of previous immunization was not subject to verification.

Principles Of Hernia Repair†

W. W. ARMISTEAD,* D.V.M., Ph.D., College Station, Texas

HERNIA results from a disparity between pressures on two sides of a weakened wall or barrier. In the most common hernias, the abdominal variety, a weakening or break in the continuity of the abdominal wall allows some part of the abdominal viscera to protrude into adjoining tissue or space. Because of this disparity in pressures, the surgical repair of a hernia must involve obliteration of the opening or "hernia ring" by some means which is, and remains, mechanically sound. Consequently, not only must a proved surgical procedure be carefully followed, but for best results the surgeon must understand and rely on some basic principles.

Basic Principles

Recurrence of herniation following what seemed for a time to be a successful repair is not infrequent. Most such recurrences can be logically explained as well as prevented.

Etiology. Several factors are involved in the etiology of hernia although their relative importance varies in different kinds of hernia. In inguinal hernia, all three factors — congenital, endocrine, and traumatic — may be of equal importance. A congenitally large inguinal ring may predispose the animal to hernia; the relaxation and loss of tone which abdominal and pelvic structures undergo in old age or under some endocrine disturbances may further set the stage for inguinal hernia; and trauma or exertion may then become the immediate cause of herniation. In diaphragmatic hernia, trauma is the principal cause. On the other hand, endocrine factors evidently contribute most to perineal hernia, which in the dog appears to occur only in the male. Blakely and others at the Angell Memorial Hospital have established the fact that castration decreases the probability of recurrence of perineal hernia.

When to Undertake Repair

Whenever possible hernias should be repaired soon after they occur. There is a direct relation between the duration of hernias and the incidence of recurrence. In a long-standing case, adhesions are likely to be extensive and distortion of tissues and rigidity of the hernial opening usually make closure more difficult. Of course, traumatic hernias also may be difficult to repair immediately after occurrence because of shock, local hemorrhage or swelling, or other critical injuries to the patient. However, the surgeon seldom is justified in postponing operation for more than a few days.

Postponement of surgery is particularly hazardous when a loop of intestine is incarcerated. Strangulation of the loop may develop quickly, followed in rapid succession by shock and peritonitis. Under such circumstances the parenteral administration of fluids, preferably blood, and antibiotics will greatly improve the chance for survival. Intestinal strangulation constitutes an emergency calling for immediate surgical intervention.

Importance of Asepsis. Strict asepsis is essential to consistent success in hernia repair. Many recurrences following herniorrhaphy are the results of wound infections which devitalize the sutured tissues and destroy their tensile strength. Infection sufficient to cause wound disruption may exist without excessive swelling or suppuration and regardless of the kind of sutures employed.

Suturing. Interrupted stitches should be used mainly, if not entirely, in repairing hernias. Continuous sutures, although quicker to place, are undependable where continuing movement and strain are anticipated because failure at any one point loosens the entire suture line. Small gauge suture material is to be preferred. In small animals, size 0 or 00 is appropriate for most purposes since the tensile strength of even size 1 surgical gut exceeds the "holding power" of fascia. Only square knots should be used and these should be reinforced with an extra "throw" or two. "Granny" knots often slip or come untied. The so-called surgeon's knot has a number of disadvantages: (1) It is difficult to tell when it has been pulled snug, (2 the sawing action necessary to tighten this knot may break the suture fiber, causing the stitch to give way

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*Dean, School of Veterinary Medicine, Texas A. & M. College.

later, (3) since the two "throws" are unequal in size, the knot often comes untied, and (4) the surgeon's knot is larger than the square knot and thus less desirable in buried stitches.

Diaphragmatic Hernia

There is considerable difference of opinion as to the best avenue of approach in the repair of diaphragmatic hernia. Access to the ruptured diaphragm may be gained through either a thoracic or an abdominal incision, but the latter seems to have some advantages.

Advantages of the Abdominal Approach in Repair of Diaphragmatic Hernia. The abdominal incision can be made more quickly and easily than can the thoracic incision. Furthermore, the abdominal incision involves less hemorrhage and no damage to ribs. It is ordinarily easier to pull the prolapsed viscera back into the abdominal cavity than to push it back through a thoracic incision. An abdominal incision permits inspection of the peritoneal cavity for evidence of other injury. (Because diaphragmatic hernia usually results from compression injuries of the abdominal region, simultaneous injuries to intra-abdominal organs are common.) Also, the abdominal operation rarely is followed by postoperative pleural effusions or evidence of intercostal pain.

Paracostal Incision. Although most texts describe a median line abdominal incision, we at Texas A. & M. prefer an anterior flank incision just behind, and following the contour of, the last fused ribs. This incision is made in the side nearest the diaphragmatic rent as determined by *x*-ray studies. In hernias of long standing in which extensive intrathoracic adhesions of the abdominal viscera are anticipated, a thoracic approach through the seventh intercostal space may be more convenient than the abdominal approach.

Reinforcing the Difficult Closure

It is often difficult or quite impossible to properly close the defect in a hernia which has resulted from violent trauma or which has existed for a relatively long period. Loss or displacement of tissue needed for snug closure may prevent coaptation of edges of the hernial opening. Too much tension on coapting stitches results in excessive swelling, cutting through of the supporting tissues, and disruption of the closure. Unless the hernial opening can be completely closed, without undue stress, recurrence is almost assured. In addition to these considerations, the repair of a diaphragmatic rent must also be air tight.

In human surgery, fascia or various metallic or plastic materials have been used to reinforce the closure of large hernias. Not only are such materials not readily available to the veterinary surgeon, but they have serious inherent disadvantages. In veterinary surgery a small skin autograft sewed as a patch over the suture line serves admirably to support and seal the hernia closure. Skin removed from the patient's own body after careful preoperative scrubbing may be used to reinforce deep hernias without danger of infection and with the expectation that it will remain intact and viable in the vast majority of cases. In most species, skin for this purpose is best taken by simple dissection from the inner thigh where hair is sparser and the resulting scar less noticeable than on other areas of the body.

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Aseptic Veterinary Surgery

(Continued from page 80)

strength of a suture line depends not so much on the size of the suture material as on the number of stitches. Fascia is one of the strongest "soft" tissues of the body from the standpoint of suture-holding ability. Yet it has been shown that the tensile strength of even size 1 surgical gut exceeds the holding ability of fascia in most species of animals. This means that, under stress, sutures of gauge 1 or larger would tear out before they would break, if the knots were properly tied. The strength of a closure may be increased by increasing the number of stitches. Of course more stitches than are needed will unnecessarily delay healing. The competent surgeon, through judgment and experience, will arrive at the "happy medium."

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A Case of Vulvo-Vaginal Stricture in a Beagle Bitch

RICHARD BINDER, D.V.M., St. Louis, Missouri

The purpose of this report is to describe the surgical procedure used to alleviate a stricture of the vulva and the vagina, and thereby allow normal coitus.

A two-year-old Beagle bitch was presented December 27, 1955, with the history of being in season and having difficulty in accepting the male. That is, the male could not perpetrate an entrance of the penis into the vagina. This was the first time the bitch had been allowed with a male during heat; therefore, this condition was not noticed at previous heats.

Upon examination, a stricture, just inside of the vulva, was palpable. It was impossible to facilitate entry of the vagina with the small finger. The bitch was able to micturate normally and an opening into the vagina about the size of an ordinary lead pencil was ascertained.

It was advised that the dog be taken home till it had gone out of season and then brought back, at which time correction by surgery would be attempted. This was done having in mind that the blood supply to the part at this time would have returned to normal, and the vulvular distension would have subsided.

The bitch was returned to the clinic January 17, 1956, and surgery was performed the following day. Following is the description of the technic employed in correction of the stenosis.

The dog was anesthetized and placed in dorsal recumbancy. The perineal region was clipped and the area scrubbed with a suitable cleansing agent.

The initial incision was started at the dorsal commissure of the vulva and extended downward for about 1¼ in. along the perineum, through the skin, subcutis, and fascia. By blunt dissection, the serosal surface of the roof of the vagina was exposed. Next, using a blunt dissecting scissors the stricture was divided at the dorsal commissure of the vulva. It was found at this time that the stricture continued into the vagina, and it was necessary to extend the division along the roof of the vagina to a point just beyond the external urethral orifice, dorsal to the line of division, before the stricture was abolished. Closure was perpetrated by using interrupted sutures of medium vetafil, beginning at the innermost point of incision of the vagina and the ventral portion of the incision in the skin.

Aftercare consisted of a prophylactic dose of penicillin and streptomycin, and daily cleansing of the area. No untoward reactions were noted and the sutures were removed seven days postoperatively.

Digital palpation subsequently revealed complete elimination of stricture. Prevention of conception due to this factor should no longer be a problem.

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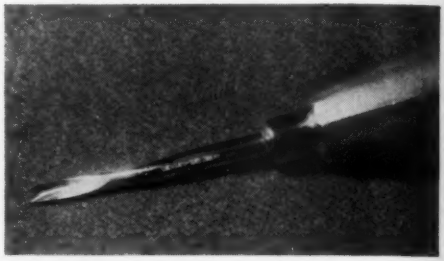
Improved Dental Elevator

To avoid the danger of a dental elevator slipping resulting in damage of soft tissue of the mouth, we have altered the tip and find that the instrument serves our purposes better because of it.



A V-shaped notch and groove is filed in the cutting edge of a regular dental elevator with a triangular file (see illustration). The pronged and sharpened elevator is not so likely to slip away from the curved root of teeth causing damage to buccal mucosa of the patient or hands of the operator.

Experience with this modified instrument in our hospital in removing canine teeth of dogs and monkeys, or cheek teeth of all small animal species has been more satisfactory than that with the unmodified instrument.—*James H. Yarborough, D.V.M.*

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Canary — To Encourage Song

℞

Dextrose ..... gm. IX
Methyltestosterone ..... gr. 1/100
M. Ft. .....Powders XII
Sig. Feed 1 pwd. daily mixed in ¼ tsp. of hard boiled egg yolk.

(The above is useful also to stop laying in females.)—*Alan Bachrach, D.V.M.*

Ancient Veterinary Jurisprudence†

A. BARTON, B.S., B.A., D.V.M.,
Forest Hills, New York

The Code of Hammurabi attests that the principles of law have not changed for 4,000 years. One is profoundly impressed in noting that in spite of all the cataclysms that have taken place, the human mind has not changed in this domain and society had to face the same problems we do today and solve them in the same manner. The Babylonian requirements relative to contracts of sale or rent or the rules of civil and penal responsibility are found again in Roman law, then in the common law of the various peoples before being sanctioned by our modern law.

Under Greek law, the buyer of slaves was guaranteed against any hidden defect or unapparent disease, unless the seller had advised the purchaser of the existence of any vice. It seems that the same rule applied to the dealings with domestic animals, especially the horse. Dion Chrysostomus said that according to Athenian law, "the seller could be forced to take back . . . a sick animal or one that did not live up to the buyer's expectations."

A law by Solon, relative to the damage done by slaves or animals, rendered the owner responsible and obliged him to repair the damage as if he had done it himself.

Roman law, codified by Justinian, specifically regulated horse trading, and applied to it the same rules as to the traffic of slaves. The same term, *Mango,* was applied to the merchant who sold slaves or horses. Diekerhoff has shown that the dispositions of the *Edictum Aedilium Curilium* was applied without distinction to dealers of slaves or horses.

Pleindoux, in a learned study of the texts, showed that the edict *De jumentis vedundis* (on the sale of horses) was a replica of a previous law on the sale of slaves (*De mancipiis vedundis*), which sanctioned the same principles but in much more complete form.

The fact that the edict on the sale of slaves dates from about the year 710, and that it undoubtely existed in more archaic form in times more remote, while the edict on the sale of horses did not exist in the republic showed that animal trading had only a limited importance. The raising of horses was practiced in Apulia, Lucania and also in Sicily, but the breeders, who were large landowners, were not mistrusted in the least. The mancipations and stipulations sufficed to guarantee the honesty of the transactions, and the texts of Varro show that they were currently employed. Moreover, the Roman language did not have a word that means "horsedealer." The term *"pecuarius"* means cattle raiser. On the other hand, slavedealers (*venaliciarii*), who were mostly foreigners, were unworthy of any confidence. Only later, in the Imperial era, undoubtedly because of changed conditions in animal husbandry and commerce, the councillors recognized the necessity of extending to the sale of animals the guarantees accorded to the sale of slaves.

As its title indicated, the edict was applied only to horses. It was soon recognized that it was necessary to extend these arrangements to cattle and the councillors established a general edict which was so conceived as to guarantee the sale of both healthy horses and cattle.

The text of the edict *De jumentis vedundis* is as follows:

"Those that sell horses must publicly declare what diseases or defects they have. If they are ornamented (harnessed to make them sell for a higher price), they shall be so delivered to the buyer. If the seller does not do that, the buyer is given sixty days to take action to get the harness or to oblige the seller to take back the horse. Likewise, in case of disease or defect, a year is given to force the seller to take back the horse, and six months given to pay back the overcharge of the sale price. If he has sold a pair of horses, and there was redhibition, then the action is relative to the two horses."

Thus the seller of animals, like that of the slave, had the choice between redhibitory action and the action *quanti minoris* (reduction in price). Up to the second century, even both could be resorted to successively one after the other.

These are the same rules that were found applied in the Celtic laws of the land of Wales, in the Anglo-Saxon laws, and sanctioned in modern laws by all nations either by general legislation or by special laws on the redhibitory vices.

While there was a list of redhibitory vices supposedly for slaves, it did not seem that those for animals had been determined by the law. Jurisprudence admitted that the sale should be cancelled not only because of defects and diseases of the horse, but also if it did not have the qualities that the owner vouched for. As examples of annulable sales, horses

†Edited translation from Leclainche, E., Histoire de la Medecine veterinaire, Office du Livre, Toulouse, 1936, pp. 87-89.

that kicked or bolted, or cattle that bucked with their horns were cited. The procedure to follow was envisaged in cases where the animal with a proven vice died, or in cases where horses were sold in pairs, et cetera. In other words, all the possible circumstances that could confront modern law, were foreseen in Roman law.

The same is true for damage caused by animals. The Law of the Twelve Tables put the responsibility on the proprietor who had to repair the damage or get rid of the animal. Likewise the civil and penal responsibility could be evoked in the case of damage caused by man to animals.

The texts of laws codified today reproduce those of Roman law nearly word for word, and were inspired by the same principles.

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Ether — to Kindle Blaze

A few days ago we read in a daily paper that a minor explosion, no great damage, had taken place in a small animal hospital during the ether anesthetization of a dog. Such an incident is not impossible when there is fire in any form in close proximity of the operation. Veterinarians will recall from their college days that ether is explosive in mixtures of 1 to 36% in air, and also in the vicinity of oxygen in a dilution of one in 41%. The general precaution not to permit fire in the vicinity of ether vapors is as important as when the gasoline service station operator asks you to "shut off" the engine when the supply in the tank is being replenished.

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Antirabies Vaccination

(Continued from page 85)

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Bat Rabies

Since the country's first reported case of bat rabies occurred in Florida in June 1953 (see VETERINARY MEDICINE, 49:133 [April], 1954; 49:206 [May], 1954) there have been 175 cases diagnosed in widely diverse geographical areas of the United States.

A basic question is whether the disease has always been present among insectivorous bats of the United States and we are only now discovering it, or whether it represents a recent northward invasion into this country from the known infected vampire bat rabies (derringue) areas of Latin America.

The latter possibility is considered tenable and even probable considering some known facts regarding habits and intermingling of various species of these feral mammals.

The epidemiological question of greatest importance is whether or not the bat represents an important reservoir of rabies in this country. If presently continuing studies ultimately show this to be a fact, the problem of control assumes even more formidable aspects. A positive finding might explain perpetuation of the sylvatic disease and the bizarre geographical and cyclic patterns observed. A related and serious problem is whether or not bats are symptomless or true carriers of disease. That vampire bats are capable of transmitting rabies for considerable periods without exhibiting symptoms of illness is known. If this is true of the indigenous species, the problem is further complicated and serious. Much more investigational work will be required to answer these questions. In the meantime, every instance of strange behavior of these creatures or known instances of attack should be reported to authorities.

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Incidence of Poliomyelitis Lowered for 1956

Though incomplete, figures reveal that incidence of poliomyelitis in 1956 continues to be lower for the past calendar year than in 1955, and also lower than for any other year since 1947. The 47.5% reduction in number of cases for the first 50 weeks in 1956 as compared with the same period in 1955 is about twice as great as the reduction between 1954 and 1955, according to report in *Morbidity and Mortality Weekly Report* for December 28, 1956.

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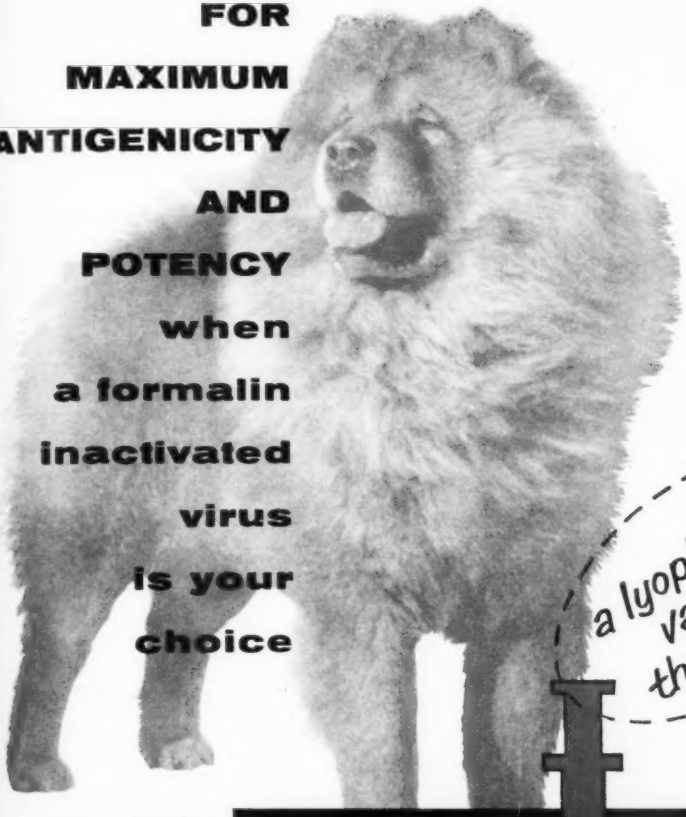

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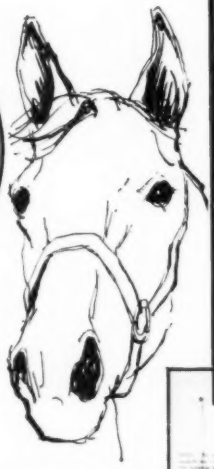

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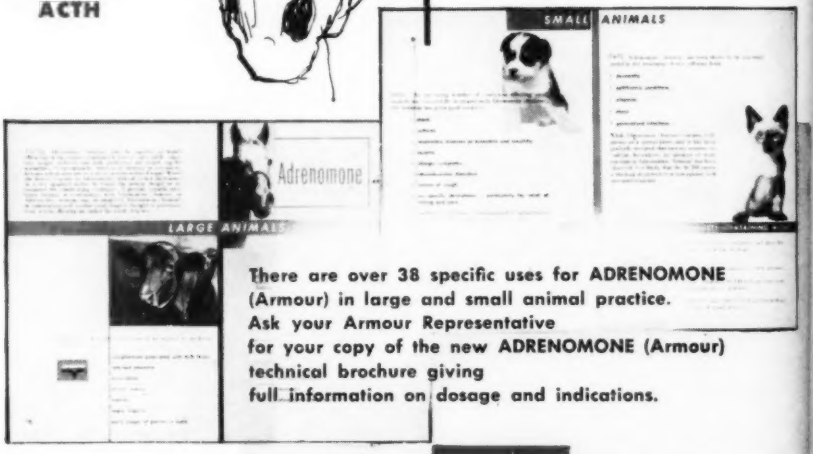

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EDICINE

(Continued from page 74)

animals. The animals utilized were considered susceptible on the basis of previous successful experimental transmissions with animals from this herd.

Discussion

The observed symptomatology and pathology of a mucosal-like disease in calves is rather similar to that observed for the early stages of mucosal disease in older animals. Numerous reports over the past calving season by livestock owners indicate that this condition was an extensive one in the North Dakota area. The majority of these herd problems could not be directly observed because of isolated ranch conditions and the inclement weather that prevailed during calving season. Numerous cases of peracute enteric and respiratory conditions in calves brought to our attention by veterinarians and owners proved to be mucosal-like anomalies upon necropsy. Attempts to transmit the condition herein described by feeding of milk or administration of blood or splenic emulsions to apparently susceptible animals were not successful.

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Experiments at the Foot-and-Mouth Disease Research Institute at Pirbright, England reveal that the unweaned mouse is susceptible to foot-and-mouse disease on about the same level as cattle, which has opened up a useful field for tests.

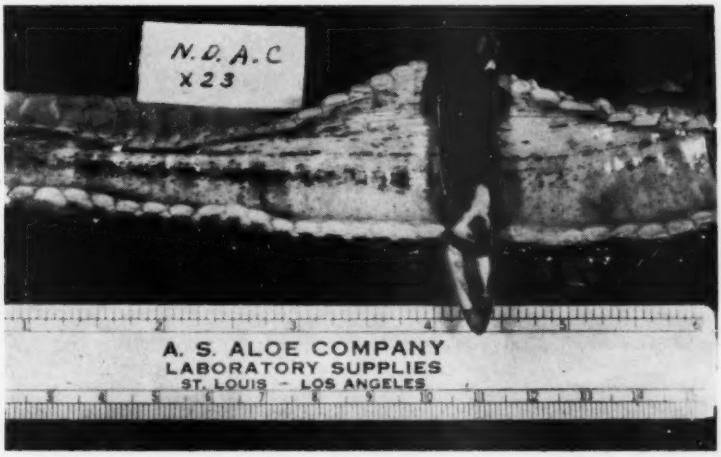

Fig. 3. Diffuse hemorrhage in the trachea of calf dead of mucosal disease.

Spontaneous Spermatic Arterio-Venous Anastomosis

JOSEPH T. McGINITY,* D.V.M., and
ROBERT FUCH,** D.V.M.

This case is being reported because it is the second of its kind observed in the Missouri University Clinic during the past four years.

This yearling Hereford steer, weighing 750 lb., was first observed on March 20, 1956. The patient was castrated at two weeks of age by a layman. The owner first noticed a slight enlargement in the scrotal area. During the next 63 days, the swelling became progressively larger at which time the steer was presented at the Clinic.

The patient exhibited no symptoms except the swelling in the scrotal area. Upon palpation of the involved area, a definite arterial pulsation was observed. This had a definite character quite the same as the pulsation of the middle uterine artery during the last three months of the gestation in a heifer.

Diagnosis at this time was tentatively made of pathologic anastomosis between the spermatic artery and vein.

All feed, except a small amount of grain and water, was withheld for three days. Surgery was performed on March 23. After routine preparation of the operative site was completed, the area was blocked locally with 40 cc. of 2% procaine. After carefully incising through the skin, the rest of the procedure was completed by blunt dissection. Fig. 1 shows the spermatic arteriovenous system after dissection. A proximal ligature of no. 1 nylon was placed around and transfixed to the artery and vein. Forceps was placed distal to the ligature. The remaining portion distal to the forceps was removed. Excess and traumatized fat was also removed. The surgical wound was allowed to heal as open wound. Fig. 2 shows the thick walled artery dissected open. Fig. 3 shows the vein dissected open. (Needle indicates direct communication of the artery anastomosing with the vein, which substantiate the diagnosis).

Fig. 1. Spermatic arteriovenous system after blunt dissection. A indicates the artery; V the vein.

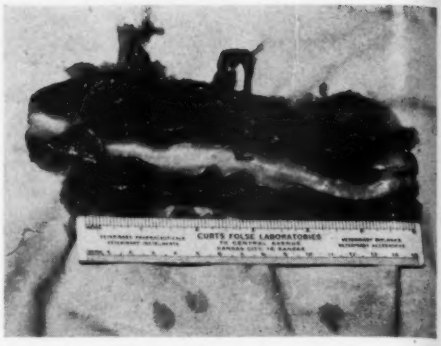

Fig. 2. Artery dissected open (arrow).

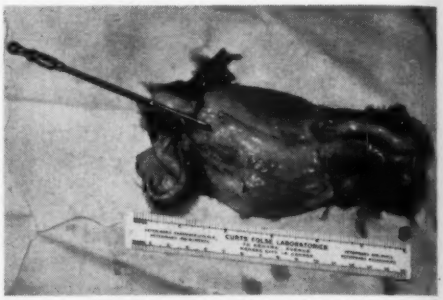

Fig. 3. Vein dissected open. Point of needle indicates direct communication of the artery anastomosing with the vein. Arrows indicate three valves of the vein.

The patient was observed for 24 hours following surgery and then discharged and placed on clean pasture to assure adequate exercise. The patient did not develop any complication and complete recovery ensued.

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What is accomplished today rests on fundamental facts revealed during the past.

*Dept. of Medicine and Surgery, School of Veterinary Medicine, Univ. of Missouri, Columbia. **Practitioner, Jefferson, City, Mo.

EDITORIAL COMMENTS

Report of the 27th Annual Meeting of the Florida State Veterinary Medical Association, Pensacola, Florida, September 23-25, 1956

Kept indoors by the winds of hurricane Flossy and the accompanying deluge of rain, the 27th annual convention of the Florida State Veterinary Association, held in Pensacola, from a literary standpoint was considered to be among the most successful of a long list of well planned annual meetings. Though relatively young among state veterinary associations, the Florida group recognizes the pressing need for technical information to the end that its members be qualified to give the best service possible to clients. Members have not only accepted the challenge of this premise but have given enthusiastic cooperation to advancement of technics by seeking outstanding talent for feature presentation at their annual meetings and encouraging all members to participate. They have found much pleasure and satisfaction in learning from one another too, in that session unusually designated as the Clinical Demonstration Session. This preconvention feature, is regularly one of the best attended sessions of the entire meeting. Up to 40 veterinarians, guests and members, are assigned various topics or demonstrations of technics in which they have acquired special skills.

An editorial in the *Pensacola Journal* welcoming visiting delegates said in part: "The work of this organization (F.S.V.M.A.) has become increasingly important over the years and certainly, today and on a national scale, its contribution in terms of public good has been no inconsiderable one. Whether it be the health of the public insofar as it is concerned with the meat we eat, or the health and safety of domestic pets, the profession has proved itself of inestimable value.

"The latest technics and developments in veterinary medicine are important to each one of us, and we may hope that this convention will lead to yet more progress."

More than 200 veterinarians and their wives attended the three-day meeting which was also the ninth annual convention of the Ladies Auxiliary.

Feature speakers on this year's technical program included Dr. W. W. Armistead, dean, School of Veterinary Medicine, Texas A. and M. College, College Station; Dr. David Bartlett, American Breeders Service, Chicago, Ill.; Dr. L. K. Firth, practitioner, Canton, Ohio; Dr. John P. Fox, M.D., Department of Tropical Medicine, School of Medicine, New Orleans, La.; Dr. Frank A. Hayes, School of Veterinary Medicine, University of Georgia, Athens; Dr. B. F. Hoerlein, professor, Small Animal Surgery and Medicine, School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn; Dr. James W. Newberne, Pathology Research Laboratory, Pitman-Moore Co., Indianapolis, Ind., and Dr. Walter L. Newton, M.D., Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.

One paper presented by Doctor Hoerlein, Clinical Spinal Conditions of the Dog, appears in the December 1956 issue of VETERINARY MEDICINE, page 575, and the second by him, Practical Small Animal Diagnostic Roentgenography, appears in the January 1957 issue of

Officers of the Florida State Veterinary Medical Association are left to right: Dr. Ed Whaley, Kissimmee, president; Dr. Ralph Porter, Quincy, treasurer; and Dr. Robert Knowles, Miami, secretary. Not shown is Dr. Ben Plummer, Ft. Myers, vice president.

this journal, page 21. Others, insofar as they were available for publication appear in this month's issue through the courtesy and cooperation of the association through its secretary, Dr. Robert P. Knowles of Miami and the program chairman, Dr. W. F. Jackson, Lakeland.

As was indicated, a howling gale and a deluge of rain kept conventioneers indoors restricting to some considerable extent social activities planned. Nevertheless these too served one of the important functions of a state association, to foster friendly cooperative relationship between members. This was the first time the Association has met in Pensacola.

Officers elected to serve the group for 1956-1957 were installed during the final session: Dr. A. E. Whaley, Kissimmee was elevated from his position as vice president to president succeeding Dr. Peter S. Roy of Jacksonville. Dr. E. Ben Plummer, Ft. Myers was elected vice president, and Dr. Robert P. Knowles, Miami and Dr. Ralph W. Porter were retained as secretary and treasurer, respectively.

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Farm Bureau Recommended End to Controls

"An era has ended," states a report in the current issue of the *Farm Journal* (Jan. '57). Referred to was the spirited debate within the American Farm Bureau Federation on the question of flexible *vs.* fixed crop supports. The issue is no longer debatable, according to the consensus expressed by the reports. Action trends were voiced by President Charles B. Shuman who proposes that the AFBF recommend that authority for the secretary of agriculture to buy and store farm commodities be eliminated completely. The Soil Bank Plan will eventually relieve the present surpluses if its administration is properly directed only toward the goal of continuous production for demand.

"Implementation Through Education"

A report of the president of the Colorado Veterinary Medical Association, Dr. Harold J. Hill, appearing in the December 1956 issue of the *Rocky Mountain Veterinarian*, points up advantages of making available useful information regarding disease control to livestockmen. Doctor Hill referred to experience of the American Dairy Science Association in which an attempt was made at their annual meeting to present the best scientific information on various phases of mastitis control. The experiment impressed dairymen and confirmed for others that an enlightened client was a good client.

The idea was extended at a joint meeting of feeder-cattle operators and veterinarians held in Greeley, Colo. on Nov. 26, 1956. The specific discussion referred to was presented in response to question posed by cattlemen regarding variation in the cost of professional service to their stock under apparently similar situations. A group of veterinarians was asked to discuss factors affecting cost of veterinary service. This was handled so thoroughly that listeners commented favorably. General costs of conducting a practice, estimated returns for dollar value invested in veterinary service, complications of disease processes, selection of treatment methods, and equipment provided for handling stock was brought out as factors influencing costs. The open discussion that followed revealed that few livestockmen realize overhead expenses of conducting a practice or what proportion of service charge is actually drug cost. The fact that a veterinarian has to go to college for six years to prepare himself for service did not, in the minds of those present, license the practitioner to make excessive charges nor to set himself up in a field comparable to the human physician. A well-done job fairly priced appeared to carry much more weight with these men. They also have little

Officers of the Women's Auxiliary of the Florida State Veterinary Medical Association are left to right: Mrs. George Yopp, Jacksonville, vice president; Mrs. Ronald Jackson, St. Augustine, president; and Mrs. Peter S. Roy, Jacksonville, secretary.

respect for the veterinarian who apparently reaps a financial harvest on the misfortune of others.

Doctor Hill concluded his remarks by expressing the conviction that benefits are possible to both cattlemen and veterinarians provided each has made clear the reasons for action and the problems of the other. The medical mystic no longer exists; "the answer is not to tear the information label off the bottle but to educate the client that you can do the job better than he."

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Penicillin in Fluid Milk

The third nationwide survey to determine the presence of penicillin in the market supply of fluid milk has revealed that 5.9% of 1,706 samples contained measurable amounts of this antibiotic. This is considerably below the calculations accumulated from results of the second test which involved only 474 random samples, 11.6% of which gave positive reactions.

The consensus of 31 authorities on allergy rather generally agreed that quantities present would not sensitize nonsensitive individuals, however, they were unanimous in the opinion that a person "exquisitely" sensitive could well react to the amounts of penicillin determined in some milk samples. No accurate figures exist of the percentage of the population known to be exquisitely sensitive but has been variously estimated to be below 10%.

The Food and Drug Administration has devoted itself to this important problem and according to the *Federal Register* for Oct. 17, 1956, has issued a strengthened policy statement as a preliminary step to further action that may be necessary (see VETERINARY MEDICINE, 51:VII [Oct.], 1956). Warnings are now required to be printed on immediate containers, instead of package circulars, against use of milk from any treated quarter for three days after treatment.

Public Health agencies, which have a real interest in the problem of antibiotic laden milk, have indicated that it has not yet been demonstrated to be of sufficient significance to justify a ban on use of penicillin preparation for the local treatment of mastitis. The potential of the problem is recognized, however. Action will be recommended if accumulated data indicates that the amounts and frequency of presence of penicillin in milk is harmful.

Veterinary Education

The profession must aid veterinary colleges in the development and maintenance of effective programs of instruction, which will include in their proper balance as many of the subject matter specialties in which members of the profession are engaged as possible, according to comments of Dr. M. R. Clarkson, deputy administrator of the Agricultural Research Service.

Majority of veterinary graduates engage in practice, and accordingly college curriculums are properly weighted in terms of special preparation for this endeavor. Volume of instruction along these lines precludes sufficient attention to other fields generally recognized as veterinary in nature and which attract large number of graduates. Professional specialties do and should continue to expand responsibilities in the educational field to supplement efforts of college staffs.

Colleges are aware of the need for specially trained educators in many fields including disease research.

Doctor Clarkson's comments focused attention upon need for specialized training in the field of regulatory and disease control activities. He pointed out that with 2,500 veterinarians currently engaged in these activities exclusively that it is a matter of national importance that formal introduction to the subject be given students. In addition between 5,000 and 6,000 practitioners are participating in one or more of the current state-federal cooperative disease eradication programs. This is handled on a fee basis yet is of such profound importance to the nation that efficiency and uniformity of action by part-time participants is vital.

Agencies can assist materially as visiting lecturers and in presenting "on the job" training technics. This means the closest cooperation possible between veterinary colleges and veterinary organizations of all types. It was emphasized that though a closer working relationship can be expected to be of benefit, the responsibility of the education programs rests solely with educators in authority. Other agencies retain a position of giving such assistance as they can to the colleges when it is requested.

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It is encouraging to observe increased adoption of humane slaughtering devices by American packers since legislation to require their use was introduced (not passed) in the United States Senate and House in 1956.

Farmers at the Crossroads

A paper bound, 107 page booklet by Secretary of Agriculture, Ezra Taft Benson, is being made available by Enterprise Foundation, 210 East 43rd Street, New York 17, N. Y., at $1.

This book deals with the basic economic problems faced by the farmer. Its purpose is to explain in simple language the economic principles that have brought agriculture face to face with the price-cost squeeze. This untenable position is due, according to Benson, to government price and acreage control policies that take "away the initiative of management, making it impossible for farmers to make the most efficient use of their machinery."

With a strong leaning to *laissez faire* economics, Benson nevertheless stands ready to allow the government a wide spectrum of regulatory activity. The continuing nature of the farm problem makes it impossible to do otherwise, according to Benson. The "heroic measures" required during the 30's should have "remained emergency measures," writes Benson, "and should not have been permitted to accumulate tendencies toward subordinating the whole economy under the permanent control of the federal government."

Unique in world history, the farm economy today is concerned with the distribution of abundance, not scarcity. The secretary of agriculture, while exercising nominal control over one sector of the economy, has little or no influence over business practices in other industries that directly affect the farmer. Although Benson makes no mention of it in his book, Henry Wallace tried to solve the problem by destroying real wealth (pigs and fruit) to increase money income.. Benson leaves no doubt, however, that destruction of the nation's real wealth to increase the farmer's income can have no long range salving effect. In fact he argues that John Donne's poetry "—send not to know for whom the bell tolls—" has sound economic foundation.

The American economy—particularly the farm economy— is not a closed system, according to the Benson analysis. Price quotas of necessity demand rigid acreage allotment. Without freedom of operation on the individual level, optimum efficiency can not be reached. As the stones fall into place, the Benson syllogism spells out peonage for the farmer in the long run if rigid price supports are followed. The case of high supports for cotton, for instance, has resulted in the following set of statistics: During the past 25 years cotton acreage has dropped from 43,000,000 to 17,400,000; domestic and foreign consumption dropped accordingly. At the same time foreign production jumped sharply and gained a toe-hold in the international market.

Fifty-six percent of the farm income is derived from products that have no price supports, among them being poultry and meat foods. Farmers at the Crossroads clearly defines the area of the problem, probably for the first time. It would seem that the attempt to preserve "a rural way of life" ranks with the production of farm products as a factor to be considered in developing farm policy. Sociology and economics in turn are caught up in politics.

This little book bears the label, "non-political," and if such a thing is possible it fulfills its purpose. This book is basically optimistic. While it holds that some of the rigid price support policies can lead only to disaster, it nevertheless points with confidence to the future. There could hardly be full agreement from everyone on Benson's statement here, least of all from political opponents. But everyone, whether a supporter of the secretary or not, owes to the stimulation of thought that his essay provokes, a very great debt.

Recommended reading for practitioners serving farm areas. A supply for distribution among clients is available from the publisher at reduced rates.

* * *

Noah's Ark Discontinued

Noah's Ark, a half hour television program based on the experiences of two veterinary practitioners, will be discontinued March 5, according to telegraphic advice from Olan Soule, associate producer. Actual production of individual episodes was scrapped January 8.

The action came as a result of unsatisfactory viewer ratings. Jack Webb, producer of series, voluntarily released the National Broadcasting Company from a 39-week commitment.

Veterinarians throughout the country had encouraged the program for its public relations value.

When the program leaves the air, an avalanche of mail can bring it back, Soule pointed out. The producing firm, Mark VII Ltd., North Hollywood, Calif., will continue to produce its Dragnet TV program, which stars Jack Webb.

Skeletal Changes Associated With Dwarfism

A study of the skull and lumbar vertabrae of dwarf cattle has revealed definite abnormalities in shape of the occipital condyles of the skull and transverse processes, dorsal articulations and body shape of the lumbar vertebrae.

These variations are pointed out by Buchanan[1], *et al.*, reporting extensive observation. Illustrated are clearly distinguishable differences in the lumbar vertebrae of dwarf types and normal calves. Attention is called to the ventral outline of the lumbar area of affected animals where each vertebra gives an irregular and pointed outline. The ventral edge of each lumbar vertebra is shortened giving the body of the vertebra a triangular rather than rectangular outline from a lateral aspect. Thus the bodies of the vertebrae constitute a lessened proportion of the ventral length of that section of the column without change in that of the main axis.

Transverse processes of the lumbar vertebrae are consistently shorter than normal in dwarf types and flattened in a variety of irregularities. An arthrodial type of joint is also described.

Variations in the shape of occipital condyles also appear to be associated in dwarf types with or in the absence of other bone changes.

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New Farm Designs Stress Saving of Labor, Fertilizer, Protein

That familiar cluster of barns, silo and dwelling, long a fixed scene in the rural landscape, will become as rare as the dray horse and windmill, if agricultural engineers have their way.

New designs for farm buildings would relocate storage and animal housing to permit the easy rotation of livestock around the fields with the crops. They also would separate the family living quarters from the work areas.

The new look is intended to conserve labor, natural fertilizers, and protein. To as great an extent as planning permits, livestock would be self-fed and would spread manure directly on the soil as the rotation schedule carried them around the farm.

The engineers point out that three-fourths of the feed consumed can be returned as fertilizer, but today outdated farm designs permit much of it to escape through drainage systems or to be concentrated around trees at the farmstead.

Barns would be of simple, flexible design for multiple use, and in many cases movable. A farm office away from the home is recommended.

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Red Clover Hay Dermatosis

J. W. FEETE, D.V.M., Waupaca, Wisconsin

On January 25 of this year, I was called upon to examine a grade nine-months-old Guernsey heifer. The heifer was kept in a well lighted stable along with three other cows and under good management.

The heifer exhibited a dermatosis characterized by erythematous inflammations, swelling of the skin and vesicles that rupture to form pustules then dry crusts. The areas affected were on the back of the hind legs, perineum, developing udder, underside of abdomen and one lesion on the muzzle. The condition was manifested in the finer haired areas. There was no temperature and the animal ate well. Intense pruritus and discomfort were evident.

On obtaining a history from the owner it was learned the animal was fed red clover hay exclusively with ground grain. The skin eruptions had first been noticed five days previous to our call.

As treatment, it was recommended that the red clover hay be eliminated from the diet and other hay substituted. A soothing ointment was dispensed for local application.

On February 16, I was called back to test the herd prior to sale and found the heifer had recovered completely. The owner reported that after withholding the red clover hay for two days, lesions begin to clear and complete recovery occurred within a week.

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Illinois regulations governing feeds containing diethystilbestrol have been amended to allow incorporation of the synthetic hormone for feeder cattle weighing 450 to 1,200 lb. Former ruling prevented feeding of stilbestrol to animals weighing less than 600 lb.

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[1]Buchanan, M. L. Some Skeletal Changes Associated with Dwarfism in Cattle. N. D. Agric. Exp. Stat. Bul. 408, Apr. 1956.

[2]Yaw, Wm. H., *Agr. Eng.*, Summer 1955.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.

Manhattan, Kansas

Reduced Parakeratosis on Zinc Deficient Diet

The relationship between calcium intake and zinc requirement in preventing or relieving parakeratosis in swine seems now reasonably well established. For example, Stevenson and Earle of the USDA, Agricultural Research Service, Beltsville, Md., report in the November 1956 number of *Journal of Animal Science* that when "the diets of growing pigs contain up to 1% of calcium, the minimum zinc content for the prevention of parakeratosis is between 44 and 80 p.p.m." Research indicates the parakeratosis developes in pigs when a ration containing 32 p.p.m. of zinc was fed. When fed 80 p.p.m. pig returned to normal; scabs were shed at the end of 28 days. When six of these pigs were shifted back to 32 p.p.m. of zinc "definite lesions of parakeratosis appeared in three of six animals after 28 days."

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Radioactive Fallout

Five days after an A-bomb explosion in Nevada there was a marked increase in radioactive iodine in the thyroids of cattle that had been grazed in the area. The given explanation is that fall-out of nuclear explosions is on grass and foliage so that grazing animals get comparatively large amounts of the isotope. Human thyroids in the same area have less than one thousandth of that in cattle. In human beings this is said to be only a small portion of the radiation received in chest *x*-rays, and therefore is considered harmless in the latter at least.

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A combination of two natural hormones—progesterone and estradiol—in the form of a "pellet implant" to speed gains and reduce feed costs has been approved by the Food and Drug Administration for use in feedlot steers—not for heifers. We understand that the marketed product is now being tested to compare it with diethylstilbestrol—the latter used for little over a year to hasten weight gain at lower cost.

Closely Related Virus Infections

New clinical diseases are continually making their appearance. This is to be expected as diagnostic methods improve, diagnostitians become more skilled, dangers from transmission of communicable diseases increase, and with greater livestock numbers. Various new modes of transportation and other factors also appear to influence these observations. Only a short time ago, we learned of mucosal disease of cattle, and gut edema of swine, neither of which entities are understood completely. Now there appears what seems to be a new upper respiratory disease of cattle, (rhinotracheitis, red nose), first reported in 1950 from western United States and now more frequently from other regions. The new bovine disease (or diseases) appears to be infectious, probably of a viral nature. Nasal discharge and saliva are possible media of transmission. Temperature of infected animal is up 103-108 F., nasal discharge, bronchial cough, and rather severe rhinitis are common symptoms. Secondary symptoms are decreased appetite, and milk secretion, sometimes abortion, and occasionally diarrhea. Weight loss may reach 200 lb. per animal. Fatal terminations are due to pneumonia, otherwise recovery in seven to ten days. Etiological agent or agents have not been isolated. Still more recently there is a somewhat well-founded belief that the conditions generally referred to as mucosal disease may in fact be a mucosal complex. In this there is grouped virus diarrhea reported from New York, red nose from Colorado, the first diagnosed mucosal disease in the Midwest, and the acute upper respiratory disease of California. Some of these conditions have all the appearances of being virus infections, possibly closely related ones.

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A reporter in *The Veterinary Record* of Sept. 29, 1956, states that in the treatment of agalactia in sows he prefers to inject 500 I.U. of a luteinizing hormone for its lasting effect, rather than pituitary extract which appears to be more transient in its action.

VETERINARY NUTRITION

MORRIS ERDHEIM, D.V.M.
Chicago, Illinois

Nutrition and Milk Yields

Work on the effect of nutrition of growing heifers on subsequent milk production is being carried on in Sweden,* and in this country.** Early reports suggest that highest and least expensive production is obtained in heifers which have been raised on "subnormal" feeding program.

This work will bear watching. There are many questions veterinarians will want answered if these early reports prove to be valid.

Will a heifer raised on a "subnormal" diet be able to withstand the stresses of the milking line and maintain high production without breaking down? What about calving problems which may result in these undersized primipera heifers? The Cornell work indicates that these heifers don't grow to "full" size by the time they are ready to deliver the first calf.

Further substantiation of these preliminary findings by later results ought not be thought of as an endorsement of poor feeding practices. Rather, it may help re-evaluate the feeds and programs we now consider "good" for cattle.

The nutritive values of feeds have been under study for a number of years.

The measurement devices used are:

1. Energy values.
2. Total digestible nutrients (commonly referred to as TDN) and
3. Starch equivalent system (Kellmer).

Most workers in the field agree that these are inadequate, and that new methods of measurement of the nutritive value of feedstuffs for cattle is essential.

The nutritive value of a feed is directly related to the contribution of energy this particular feed can make to the animal. In ruminant nutrition, we simply do not know enough about what happens in the rumen to predict how much energy a given feed will contribute.

We know that the rumen microflora react to changes in the diet. When cattle are on a high roughage diet, certain organisms predominate in the rumen. On a high grain ration, other organisms predominate. It takes up to two weeks for the picture to change completely when cattle are changed from one feeding program to another. Thus, corn might show different values when fed with a high grain ration or a high roughage ration. Moreover, some natural feedstuffs contain unidentified rumen factors which aid in cellulolytic activity. The addition of sources of unidentified rumen factors to the feeding program can affect the nutritive value of a given feed — particularly a poor quality roughage.

It is reasonable to expect that as we learn more about measuring nutritive values of feedstuffs for cattle, we will probably find reasons to make changes in our feeding programs. What has been considered a poor ingredient may show up to much better advantage. This may be accomplished by judicious combination of such ingredients with others. It may also involve deliberate tampering with the normal rumen flora by the addition of materials to the ration which would increase cellulolytic activity.

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Hormones in Dairy Feeds

Two hormones have been receiving attention as possible additives for dairy cattle feeds. One, thyroprotein, has been tested on and off for about 15 years. For a short while, a number of years, it was used commercially in dairy feeds. Despite a recent unfavorable report by USDA workers, the product is being introduced again for increasing milk production. The promoters claim excellent results in trials involving many thousand dairy cows. It is not clear, however, whether the products or feeding programs have been changed to make it more acceptable than it had been in the past.

The second hormone to receive attention in dairy feeding tests is diethystilbestrol. This stems from earlier work on the subject, and was further stimulated by the great interest in the wide-spread use of the synthetic hormone in beef cattle feeding. All of the tests reported suggest that stilbestrol is not a practical additive for dairy cattle feeds.

*The Institute for Livestock Improvement, Wiad. Sweden.
**Cornell University, Ithaca, New York.

PUBLIC HEALTH

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

Malaria

The first world wide attack on a disease is now being planned by scientists. A strategy for total war against malaria, aimed to eradicate the disease throughout the world has been developed by the World Health Organization Expert Committee on Malaria. At a recent meeting of the Committee the members not only confirmed that malaria eradication was feasible, but that its enormous economic and social advantages made it the only rational policy to adopt.

The monies required to achieve eradication within a definite time, although substantial, are much less than the cost of continued malaria control of a lesser intensiveness over a longer period. Moreover many areas of the world have had outstanding success, and they in turn have stimulated other countries to consider a total eradication program. Another reason for getting under way immediately is the growing resistance of the mosquito carriers of malaria to insecticides; for example, DDT. Once this occurs on a large scale much of the enthusiasm for the program will disappear, and malaria will again become a disease to be lived with instead of eradicated.

The World Health Organization Expert Committee points out that the technics for malaria control are well known and that all that is needed is to put them into effect. The spraying of interior walls of houses with long-lasting residual insecticides should be carried out intensively until malaria no longer remains. Concurrently, pockets of infection must be sought out so that infection can not be reintroduced into the community. As soon as the disease is eliminated the spraying campaign should be halted so as to avoid the possible development of resistance in mosquitos and in order to survey the area to determine if the transmission of disease has actually been stopped.

Malaria, for practical purposes, has been eradicated in the United States and a number of other American countries. Italy and Greece have eliminated the disease in many parts of their countries. In these areas it has been observed that agricultural production has increased dramatically. Fortunately no animals are reservoirs of human malaria although birds and monkeys do suffer from their specific kinds of malaria. Avian and simian malaria are serious problems in some areas of the world and often cause epizootics with a high fatality rate.

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Veterinary Public Health Training in France

Professor R. Vuillaume, director of veterinary services in France, has recently informed the World Health Organization that following the recommendation of the WHO Veterinary Public Health Advisory Group, the new French law pertaining to veterinary medical education, dated 10 November 1955, provides for inclusion of specialized veterinary public health studies in the veterinary school curriculums. The new law provides that in the fourth year of the veterinary curriculum the student must specialize for four months in one of three major areas:

1. Animal husbandry and nutrition.
2. Animal processing industries and inspection therein.
3. Administration and public health.

The choice of one of these three major areas is left to the student, the student making his choice at the end of the third year.

Dr. Martin Kaplan, veterinary consultant to the World Health Organization, points out that this is an important forward step in the teaching of veterinary public health in Europe and should stimulate other nations to take similar action.

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Beware of the application of heat in treatment of shock from blood loss, cautions Dr. Alan C. Burton, in the *Canadian Medical Association Journal*. Transfusion of blood or blood substitutes is recommended as a life saving measure whenever the shock level is approached.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Poultry Diagnoses by California Diagnostic Laboratories

A number of interesting and valuable observations on poultry diseases in California are given by Dr. W. W. Worcester, supervisor of laboratories in his annual report (36th annual report for period ending 31 Dec. 55, Calif. Dept. Agric. Bul. 45(2):75, Apr-May-June 1956). Doctor Worcester is supervisor of the six California Department of Agriculture Animal Disease Diagnostic Laboratories located at Fresno, Lancaster, Petaluma, Sacramento, San Gabriel, and Turlock. With the exception of the ones located at Lancaster and Turlock, which handle only poultry, the laboratories do diagnoses on all animals including poultry. The extent which veterinarians are using the laboratories for animals other than poultry is shown by the fact that 4,633 large animal accessions were recorded during 1955. It is encouraging that there has been a yearly increase in large animal disease diagnoses.

As for poultry diseases, it is of interest that the incidence of coccidiosis in chickens has decreased, probably due to the widespread use of improved coccidiostats.

A newly diagnosed disease of chickens and turkeys known as avian infectious hepatitis-synovitis first diagnosed by Dr. G. N. Lukas at the Turlock Laboratory in October 1954 (*Jour. Am. Vet. Med. Assn.*, 126:402 [May], 1955) has spread to other areas of the state. Lukas states that the etiological agent of this disease is "a fastidious pleomorphic, Gram-negative coccoid to yeast-like organism." Dihydrostreptomycin sulfate, 50 mg. per lb. of body weight injected intramuscularily is effective in controlling acute and peracute outbreaks.

Two interesting cases of *Salmonella pullorum* infection in mammals were diagnosed at the San Gabriel laboratory. One was in a herd of swine having an abortion problem. *S. pullorum* was isolated from an aborted fetus and investigations revealed that the swine had been fed offal from poultry dressing plants and hatcheries. The second case involved a calf to which the owner had been feeding raw chicken eggs as a supportive treatment for diarrhea.

It was reported that in some sections of California fowl pox has increased due to negligence in vaccination. This is also an observation which is being made in other parts of the United States. Veterinarians should be on the alert to remind poultrymen that fowl pox is likely to be a problem if vaccination is neglected.

A report of the isolation of a pleuropneumonia-like organism (PPLO) from the sinus of a goose was reported by the Fresno laboratory. The fact that the strain isolated from the goose produced sinusitis when injected into sinuses of turkey poults suggests that the goose may be added to the list of carriers of this agent, generally conceded to be a factor if not the only cause of infectious sinusitis of turkeys and chronic respiratory disease (CRD) of chickens.

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Fatty Livers in Laying Hens

Observers in the south and east have reported a new syndrome in laying birds on high energy feeds. The first observable symptom is the cessation of laying. The hens then become fat. Sudden deaths follow.

The high energy feeds which seem to be related to the onset of this condition usually contain high levels of added fat. On the other hand, many birds on such feeds do not develop this condition.

On autopsy, the most pronounced finding is a very fatty liver. On a dry weight basis, such livers contain as much as 65% fat as compared to a normal fat content of 10% or less.

One of the approaches nutritionists are considering is the addition of choline to laying feeds. The Texas workers suggest that 400 gm. of choline be added to high energy layer feeds. This additional choline is particularly important in high energy feeds containing high levels of added fat.

This seems to be another illustration of the importance of proper balance in feed formulas. When one element is changed, adjustments must be made in others to satisfy new requirements.

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 2, Missouri.

THE COMMON SENSE BOOK OF PUPPY AND DOG CARE, by *Harry Miller,* 256 pages. Bantam Books, Inc., New York, publishers, 1956. Price—$0.35.

At long intervals, sometimes decades apart, a writer attacks with vast enthusiasm the subject of vital interest not only to the veterinary profession, but also to the 17,000,000 American families that keep dogs for either sport, protection, or companionship. No one would mistake Harry Miller, the author of Puppy and Dog Care, for a professional veterinarian. But his popular account bears the marks of an expert on dogs, and he serves up this complicated subject in a simple style, the technical nature of which does not prevent it from being a brilliantly readable book. Even cursory perusal will unveil new significance in all dog problems.

Outlined and executed for easy reference, Puppy and Dog Care presents lessons in dog care from the standpoint of age groups. Whether an animal is only a few months old, or a full-grown pet, problems that present themselves are handled here with power and scope. Special treatment has been given to nutrition and feeding, ailments and accidents, as well as nursing and special care, such as that occasioned in the process of housebreaking, training, and correction of animal habits.

Puppy and Dog Care is not intended to eliminate the function of the small animal practitioner. It was written rather to complement the veterinary profession, to assist in bringing medical cases to the attention of professional help, and to guarantee through education proper care for dogs. For this reason Puppy and Dog Care can be recommended by every practitioner to his clients.

Of both academic and real interest is the section devoted to thumbnail descriptions of over 100 registered breeds in the United States, ably illustrated by the well-known artist, Paul Brown.

Puppy and Dog Care has been endorsed by Hadley C. Stephenson, B.S., D.V.M., who also contributed the foreword. Proceeds from sales have been assigned by the author to the Cornell Research Laboratory for Diseases of Dogs.

The book carries both an extensive index and a topic listing.

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VETERINARY DRUG ENCYCLOPEDIA AND THERAPEUTIC INDEX, editors *Hadley C. Stephenson, D.V.M.,* Emeritus Professor of Therapeutics and Small Animal Diseases, Cornell University, and *Stanley G. Mittelstaldt, Ph.D.,* Dean of the School of Pharmacy, University of Arkansas. 4th ed. 374 pages. Drug Publications, Inc., 49 West 45th St., New York 36, N. Y., publisher.—Price (domestic) $6.

Veterinary practitioners seldom compound their own prescriptions as did their predecessors but purchase drugs and formulae ready for use. Combinations of drugs carefully prepared for specific purposes are made available by energetic, enterprising, and highly competitive manufacturers and pharmaceutical supply houses under a profusion of names. These give little evidence of their contents—thus the need of a quick reference guide for the practitioner of available drugs and biological products.

Veterinary Drug Encyclopedia, now in its fourth edition, fulfills the purpose of a reference to 2,000 preparations of 87 manufacturers. It is considerably enlarged over the previous edition. Contents of the book are organized in three sections: (1) Drugs, Biologicals, and Foods is an alphabetical indexing of preparations by brand and generic name. Name of manufacturer, a description and formula, its action and uses, administration and supply (packaging) are given briefly. (2) Manufacturers Index is a listing of companies whose products are included with alphabetical listing of named products and reference page number. (3) Therapeutic Index classifies pathological condition then lists treatment agents with manufacturers name and reference page number to product.

Presentation makes possible rapid and authoritative reference for clinicians. It is more complete than any previous issue. Publishers are experienced in the field, having published the Modern Drug Encyclopedia for physicians for some years.

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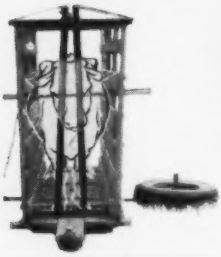

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Exhaustive consideration was given to the development of a suitable public relations program by the Georgia Veterinary Medical Association, at their annual meeting in Macon early in December. Object was improvement of that program now followed indicating the increased interest of Georgia veterinarians in methods employed in their relations to the public.

Dr. Charles C. Rife, Atlanta, is the efficient secretary of the Georgia group in addition to his duties as editor of the *Georgia Veterinarian.*

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Doctor Fisher to New Post

Dr. William F. Fisher has been appointed director of the Division of Animal Industry of the Nevada State Department of Agriculture effective January 1, 1957.

For a number of years Doctor Fisher has been assistant veterinarian in charge of the Agricultural Research Service, Animal Disease Eradication Branch Station at Reno, Nevada. He retired from federal service on December 31, 1956.

During his service as a federal veterinarian he received the Certificate of Merit from the U. S. Department of Agriculture commending him for performance substantially exceeding the requirements of his position.

Doctor Fisher is past president of the Intermountain Veterinary Medical Association and the Nevada State Veterinary Association. He is now secretary of the Nevada State Veterinary Association, their delegate to the A. V. M. A. House of Representatives and a member of the American Veterinary Medical Association, a member for many years of the Masonic lodge and a past member of the Reno Toastmasters Club. His hobbies are hunting, fishing and German Shorthair bird dogs.

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Honor Dr. George W. Grim

The American Board of Veterinary Public Health in convention at San Antonio, Texas on Oct. 15, 1956, drafted citation (excerpts of which appear below) honoring Dr. George Webster Grim, Ardmore, Pa. Ironically and without knowledge of the Board at the time this action was taken, Doctor Grim passed away on the date citation was prepared. Dr. H. J. Stafseth, president of A.B.V.P.H. was requested to make the presentation to his widow.

Born in Doylestown, Pa., Doctor Grim received his veterinary training at the University of Pennsylvania, graduating in 1916. He served with the Veterinary Corps., U. S. Army, during World War I, attaining the rank of captain. On return to civil life Doctor Grim was appointed veterinary director for the Walker Gordon Farms in New Jersey, and in 1922 as milk control officer for the suburban area of Philadelphia. He occupied that position until his death Oct. 15, 1956.

During his long service, Doctor Grim made important contributions in milk hygiene and public health and published many articles on milk sanitation, plant design, and equipment standard. He was visiting lecturer on food and milk technology at Temple University, Women's Medical College of Pennsylvania, and the University of Pennsylvania.

In citing George Webster Grim, the American Board of Veterinary Public Health honored a pioneer in the science of veterinary public health and one who represented ably veterinary medicine in public health councils.

Dr. Martin D. Baum, Denver, Colo., is secretary of this organization.

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Pan American Zoonoses Center

A newly established international center for the study of diseases transmissible between animals and man was recently dedicated at Azul, Argentina, according to special release to *Medical News* (Dec. 17, 1956).

The Center will be concerned with testing vaccines and other biological products, training personnel, and furnishing consultation services by pooling talents of a team of scientists including veterinarians.

More than 80 zoonotic diseases have been detected in the United States. Over 100 have been reported from various parts of the world. Importance of the drive on these diseases is

stressed by recent serological studies which indicated that 20% of persons under 30 years of age in Colorado gave positive blood titers for western equine encephalitis; outbreaks of psittacosis among poultry processors in several areas; incidence of brucellosis, toxaplasmosis, leptospirosis, and other entities.

Major advances in understanding are to be expected from the program of study outlined which will have benefit from a public health aspect as well as veterinary significance.

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Incidence Rate of Human Brucellosis Decreased with Reduced Incidence in Cattle

According to a recently released news item from the State of Washington the reduction in the number of cases of human brucellosis has kept pace with the control of animal brucellosis in that state. As evidence in support of this it is indicated that ten years ago the incidence of human brucellosis was at the rate of 2.6% per 100,000 of the population, though in 1955 this was reduced to a rate of 0.23%, or approximately, a ten-fold decrease.

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100 Methyl Testerone Tabs 10 mg. 1.65
1000 Stilbestrol Tabs 1 mg. 1.15
1 Rectal Thermometer 50c
(12 = 5.50)
1 Gm. Dihydrostreptomycin Nationally known brands 19c
Fortified Penicillin (400,000 units) with 0.5 Gm. Dihydrostreptomycin in aqueous suspension
5 dose vial 69c
100 cc. vial 5.95
Minimum order $10.00, check with order. We pay shipping costs.
*Sold only to graduate Veterinarians.
Bulk discount prices on request
Prices subject to change without notice.
nationally known antibiotics, therapeutics, hormones, biologicals, vitamins and pharmaceuticals for all animals

Over $1,000,000

have been paid in claims to veterinarians by Continental Casualty Company!

No other insurance plan for veterinarians has a comparable record.

Here are what some of your fellow veterinarians are saying about the program.

"Very good handling of claims — excellent service!"

H., Minnesota

"I sent in my claim and you paid it promptly. I was well satisfied and appreciate your service!"

M., West Virginia

"I was very happy with your claim service. It was very prompt and fair!"

J., Colorado

"The claim I sent in 1956 was settled with my complete satisfaction. It was paid without delay or confusion."

G., Louisiana

"We were surprised by the prompt payment of our claim. With a family of six this one policy I shall not let lapse."

W., Oregon

With this plan, policyowners share in the economics of Nation-Wide, Mass Purchasing Power and in reduced cost of administrative work and selling expense.

For information, write

SILENT PARTNER ASSOCIATES, Inc.
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Announce Symposia on Use of Corticosteriods

Symposia on the uses of meticorten® and meticortelsone® in veterinary medicine will be held in Los Angeles and Chicago in February, according to Dr. J. C. Siegrist, head of the Veterinary Medical Department of Schering Corporation, pharmaceutical manufacturer.

A one-day meeting will be held at the Ambassador Hotel in Los Angeles, February 20. The second symposium will take place at the LaSalle Hotel in Chicago, February 28. The reason for splitting the symposia between the Coast and the Midwest is to make it convenient for the greatest number to attend.

New clinical papers on a broad range of meti-steroid therapy in both large and small animal practice will be presented at each meeting.

More than 200 veterinarians attended the first symposium held in New York last November. The Los Angeles and Chicago meetings are scheduled in response to requests from veterinarians who were not able to attend the meeting held in the East.

All graduate veterinarians are cordially invited to attend either or both the Los Angeles and Chicago symposia.

▾ ▾ ▾

Mastitis Preparation Offered in New Package by Massengill

The S. E. Massengill Co., Bristol, Tenn. has announced a new antibacterial, anti-inflammatory formula for intramammary treatment of bovine mastitis.

The new preparation, developed by the Company's Research Division contains neomycin sulfate, polymixin B sulfate and methopyrilene hydrochloride. Proved efficacy of the antibiotic for controlling infection is claimed by the manufacturer. The antihistamine combats inflammation and its harmful effects.

The new package is referred to as "dial-a-dose" syringe of 60cc. A single dose (15cc.) may be administered easily by setting the plunger screw at the position marked. Syringe contains four dose and the package contains extra needles for administering each treatment.

▾ ▾ ▾

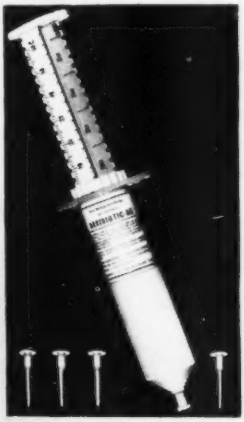
Great Britian is depending upon artificial insemination service for one-half of her 3,250,000 cows.—*Hoard's Dairyman.*

FEB

COMPLETE THERAPY
for mastitis in convenient dosage form

DARIBIOTIC®-AH

(NEOMYCIN-POLYMYXIN B with ANTIHISTAMINE)



in the "dial-a-dose" syringe

Each 60 cc. multiple dose plastic syringe contains four doses

EACH DOSE (15 cc.) CONTAINS:

Neomycin Sulfate . . . . . (Equivalent to 60 mg. Neomycin base)	100 mg.
Polymyxin B Sulfate*	100,000 units
Methapyrilene HCl . . . . . in a free-flowing, milk miscible base	200 mg.

Daribiotic-AH, in the "dial-a-dose" syringe, is available in cartons of 6. Four mastitis tips supplied with each syringe.

*Licensed under U.S. Patent No. 2,565,057

The S. E. MASSENGILL Company
veterinary division
Bristol, Tennessee

Associated
Veterinary
Laboratories

Square pegs

in

XXXVIII

VETERINARY MEDICINE

round holes ?

It cannot be done.

Neither can one make experienced veterinarians out of untrained livestock raisers — even if millions are spent in trying to do so.

The members of Associated Veterinary Laboratories* hold that the only policy for distribution of veterinary supplies is an ethical policy, because:

. . . They believe in the veterinary profession and what it stands for.

. . . They believe that biologicals and pharmaceuticals should be sold to veterinarians only — never as "shelf goods" on the open market.

. . . They believe in educating the public to always call the veterinarian, and are continuing a nation-wide campaign of public education to that end.

The member companies listed below will appreciate your cooperation and continued orders.

* Associated Veterinary Laboratories, inc.

Sponsors of American Foundation for Animal Health

Allied Laboratories, Inc.
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TOTAMIN

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- **Amino Acids**
- **Minerals and Vitamins**

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Write for an illustrated folder today or ask your distributor.

NUTRITIONAL MINERALS

Box 505, 404 E. 12th St.

Sioux Falls, S. Dak.

The nation's dog population, according to Harry Miller, director, Gaines Dog Research Center, has passed the 25,000,000 mark. This figure represents an increase of 2,500,000 dogs since 1953.

▼ ▼ ▼

Puppies two months of age and older can be safely immunized for rabies with chick-embryo vaccine, according to Dr. Merlin Kaeberle of the New York State Health Department.

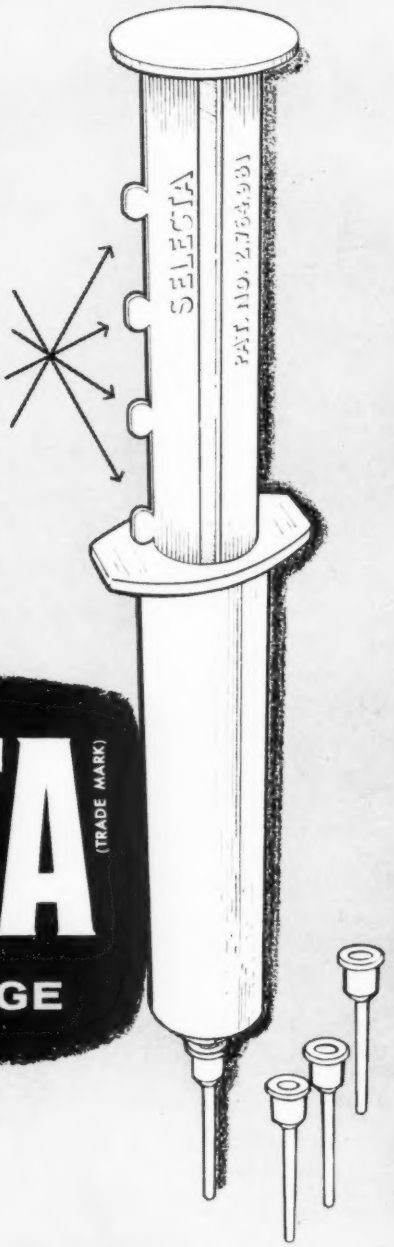
Veterinary-Nutrition Relations Committee

Mutual problems experienced by the feed industry nutritionist and the veterinarian are being brought into focus by a newly organized Committee which includes representation from the Nutrition Council of the American Feed Council of the American Feed Manufacturers Association and from the American Association of Veterinary Nutritionists, recently organized within the framework of the American Veterinary Medical Association.

Labelled the Veterinary-Nutrition Relations Committee, the group is composed of members of the Public Relations Committee of the A.A.V.N. and members of the Veterinary Relations Committee of the Nutrition Council Shown above from left to right: (Front row) Dr. Morris Erdheim, Dawe's Laboratories, Chicago, Ill., A.A.V.N., president Marvin C. Wilkening, Alabama Flour Mills, Decatur, Ala., chairman Nutrition Council Veterinary Relations Committee; Dr. R. E. Lubbenhusen, Ralston-Purina Company, St. Louis, Mo., chairman, A.A.V.N. Public Relations Committee; (second row) Dr. Roland Gessert, Federal Food and Drug Administration, Washington, D. C.; Dr. John A. Whiting, Veterinary Nutrition Consultant, Kansas City, Mo.; Dr. Ruel E. Ward, Eastern States Farmers Exchange, West Springfield, Mass.; Dr. E. M. Gildow, Albers Milling Company, Seattle, Wash.; Robert Vohs, Ames Reliable Products Company, Ames, Ia.; (third row) Dr. W. D. Pounden, Ohio Agricultural Experiment Station, Wooster, Ohio, A.V.M.A. Advisory Committee member to Nutrition Council; Elmer Modeer, Staley Milling Company, Kansas City, Mo.; Dr. John W. Cunkelman, Swift and Company, Chicago, Ill.; Dr. J. W. Nelson, Nutrena Mills, Minneapolis, Minn.; Dr. A. A. Heidebrecht, Paymaster Feeds, Abilene, Texas; and Dr. Roy E. Nichols, University of Wisconsin, Madison, Wis. The Veterinary-Nutrition Relations Committee will have a rotating membership and will meet semiannually. The first formal meeting was held in Chicago, November 27, 1956.

low cost 4-shot

Easiest, fastest, *surest* applicator now with several combinations of proved drugs. Look for the 4-tab plunger . . . that's SELECTA.



SELECTA (TRADE MARK)

MASTITIS SYRINGE

VET-WAY PRODUCTS CORPORATION
1558 Seabright Avenue
Long Beach 13, California

more and more veterinarians find that the

soothing, protecting healing influence *of*

DESITIN® ointment

is **persistent** *in*

wounds (especially slow healing)
burns • ulcers (external)
postpartum perineal tears
sore, cracked teats • otitis externa

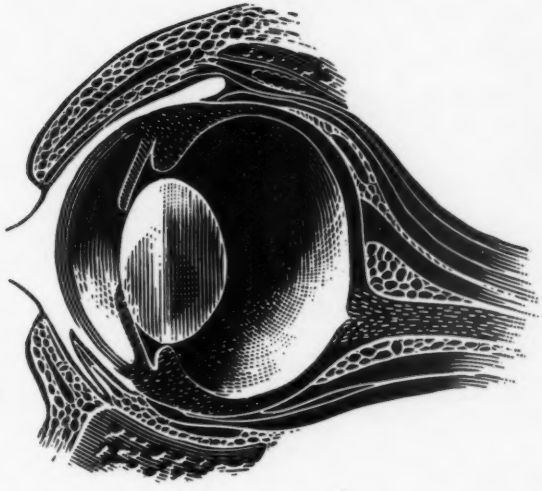
Jars of 1 lb.
Tubes of 1 oz., 2 oz., 4 oz.

. . . because DESITIN OINTMENT adheres longer to the skin areas being treated . . . does not liquefy or crumble at body temperature, nor is it decomposed by secretions, exudate, perspiration, urine or excrement.

DESITIN OINTMENT, rich in cod liver oil, eases pain, itch and irritation, eliminates necrotic debris, accelerates smooth tissue repair in many kinds of tissue injuries . . . without sensitization or irritation.

for professional **samples** *and literature, write* . . . Veterinary Department

DESITIN CHEMICAL COMPANY
812 Branch, Ave., Providence 4, R. I.



now! control of infection, inflammation and pain in eye and ear diseases

NEO-CORTEF* WITH TETRACAINE EYE-EAR OINTMENT

NEOMYCIN for broad-spectrum, topical antibacterial therapy **CORTEF*** (hydrocortisone) to suppress undesired response of tissues to inflammatory stimuli **TETRACAINE** for direct, positive, prompt, long-acting control of pain. For satisfaction: use it, dispense it, prescribe it. *Trademark, Reg. U. S. Pat. Off.

Supplied: Tubes of 5 Gm., with special, convenient applicator tip.

Veterinary Medical Department

Upjohn

THE UPJOHN COMPANY, Kalamazoo, Michigan

no side effects from
THERAPOGEN
the proven
effective germicidal
agent
You'll find THERAPOGEN virtually free of side effects and toxicity. Its completely effective yet mild cleansing action has been found excellent for obstetrical work by veterinarians for many of the finest horse breeding farms in Kentucky. Inexpensive THERAPOGEN may be ideal for your needs, also.
Write, wire or call today for samples, literature and the name of your nearest distributor.
THEO. MEYER Est.
213 SO. 10TH ST., PHILA. 7, PA.

Ralston Purina Company Research Fellowship Awards for School Year July 1, 1957 — June 30, 1958

To assist in the training of additional personnel for leadership in the science of livestock and poultry production, the Ralston Purina Company will award ten research scholarships again this year. This is the eighth year of the continuing program. Sixty-six fellowships have been awarded to date.

Awards will be made in the fields of (1) nutrition and physiology research as applied to dairy, poultry and animal husbandry (not more than three each); and (2) research in transmissible diseases of livestock and poultry (one only in veterinary science).

Any individual qualified for graduate study in any Land-Grant Agricultural College or approved Veterinary College (including Canadian Colleges) who possesses desirable personal qualifications and submits a completed application may be eligible. The application and necessary requested information must be in the hands of the Awards Committee by March 1, 1957.

Amount of Fellowship—$1620.00 annually.

Application blanks for these Fellowship Awards may be obtained by writing the Ralston Purina Research Awards Committee, c/o Mr. J. D. Sykes, Ralston Purina Company, St. Louis 2, Mo.

▼ ▼ ▼

"Operation Milkpail"

Operation milkpail designates a mass feeding program, involving some 18,200 dairy cows throughout the United States, to demonstrate the effectiveness of thyroprotein for milk stimulation. The program sponsored by Agri-Tech, Inc., Kansas City, Mo. will record the milk production of 9,100 cows fed a prepared lactation stimulant containing thyroprotein named stimulac® and an equal number of animals from the same herds which will act as controls. Test period now underway began August 20 and will extend to October 20, 1956. Selected dairy herds in 26 states are now under test.

Chemically, thyroprotein is iodinated protein, consisting of iodine and protein combined through a carefully controlled series of chemical processes. This synthetic hormone substance has identical physiological effect as the natural hormone thyroxine, secreted by the thryroid gland. Thyroprotein may be fed to animals to help maintain thyroxine activity at the desired level during lactation.

Increases in milk and butter fat production are claimed to range from 20-25% under actual field test. Furthermore, manufacturers claim no detrimental influence on the general health, longevity, susceptibility to mastitis, or breeding efficiency. Response is observed to be greater in later lactation than immediately postpartum. A low percentage (1-2%) give no apparent response.

▼ ▼ ▼

Entomologists are hopeful that another year of testing will prove that ET-57, an organic phosphate, has desirable properties of a systemic insecticide.

▼ ▼ ▼

Indication for corticoid steroids are many and varied considering its anti-inflammatory effect.

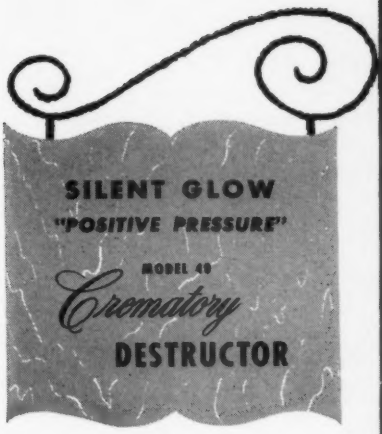
▼ ▼ ▼

Importance of bovine leptospirosis is exceeded only by mastitis, tuberculosis, and brucellosis.

®Agri-Tech, Inc., Kansas City, Mo.

the positive answer to your disposal problems . . .

WITHOUT SMOKE, ODOR OR FLY-ASH



This Crematory **DESTRUCTOR** is the *only* type that is positively fulfilling every health and sanitation requirement by completely destroying small animal and poultry carcasses, kennel waste, laboratory and hospital refuse to a white ash with "positive pressure", odorless and smokeless operation without a chimney.

The Crematory **DESTRUCTOR** improves neighborhood relations with its smokeless, odorless, sparkless operation. Immediate disposal of carcasses and waste material eliminates the need for refrigerated storage equipment, unsanitary refuse cans and scavenger truck pick-up service . . . permitting "hospital clean" maintenance of premises.

The compact **DESTRUCTOR** is easy-to-use, attractively designed and completely weatherproofed for installation in outdoor locations and environments.

Write today for list of distinguished **DESTRUCTOR** owners, which includes noted Veterinarians, Government Agencies, Humane Societies, Laboratories, Pet Hospitals, Kennels and Animal Farms.

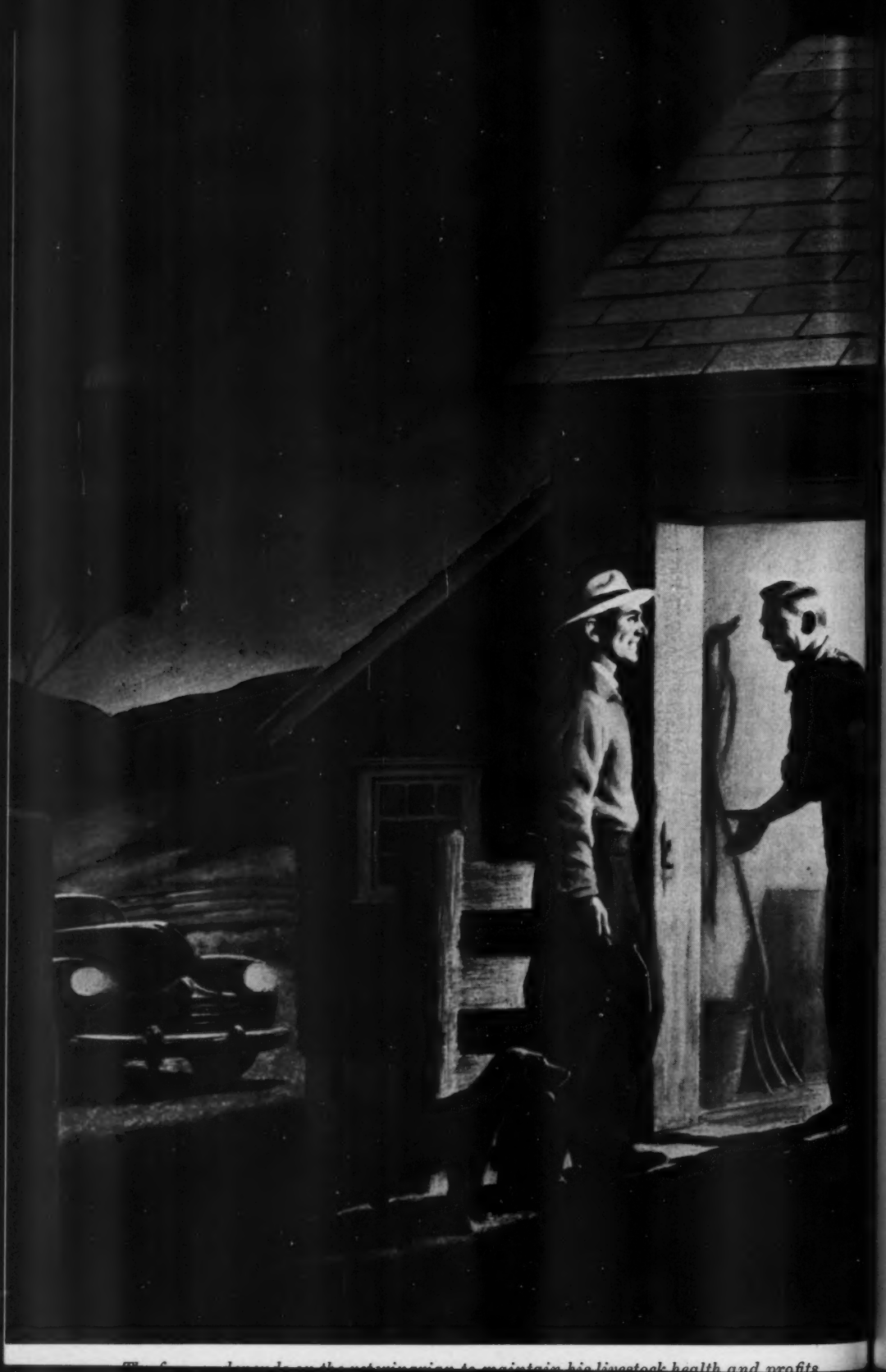
MODEL 40

Patent Pending

THE SILENT GLOW OIL BURNER CORPORATION

869 Windsor Street • Hartford 1, Conn.

For further details mail this advertisement with your letterhead.



The farmer knows the veterinarian to maintain his livestock health and profits

Why successful Veterinarians can depend on CYANAMID Products

The busy veterinarian with his sense of great responsibilty to the owners of the livestock he treats or whose health he constantly guards, must have full confidence that the medications he uses are of unexcelled quality and meet the highest standards of effectiveness.

The Cyanamid Professional Line, including the Polyotic Tetracycline products, is the result of the most exacting and advanced research coupled with conscientious production, under strictest quality control.

The range of the line is broad to provide the veterinarian with virtually every type of modern medication required in the most diversified practice.

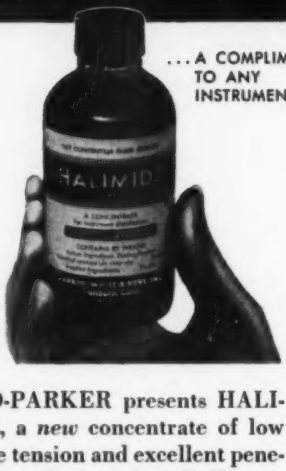
Every Cyanamid Professional and Polyotic Tetracycline product is speedily available from many points throughout the country – and Cyanamid spares no effort to render the utmost in service to the veterinary profession.

These fine products are sold only to veterinarians.

For detailed information write to American Cyanamid Company, Professional Service Department, Farm and Home Division, 30 Rockefeller Plaza, New York 20, N. Y.

POLYOTIC INTRAMUSCULAR:
100 mg.-500 mg.-1 Gm.-5 Gm.
POLYOTIC INTRAVENOUS: 100 mg.-2.5 Gm.
POLYOTIC OBLETS®: 4's-6 x 4's
POLYOTIC CAPSULES: 50 mg., 25's-100's;
100 mg., 100's; 250 mg., 16's-100's
POLYOTIC TABLETS: 50 mg., 25's-100's;
100 mg., 25's-100's; 250 mg., 16's-100's
POLYOTIC MASTITIS OINTMENT ¼ oz.
POLYOTIC COMPOUND MASTITIS OINTMENT: ¼ oz.
POLYOTIC OPHTHALMIC OINTMENT 1%:
6 x ⅛ oz.
POLYOTIC POWDER 2%: 35 Gm. Puffer Bottle
POLYOTIC TOPICAL OINTMENT 3%: 1 oz.
POLYOTIC SOLUBLE (Tinted) POWDER:
¼ lb.-½ lb.-1 lb.-5 lb.
AVIANIZED® RABIES VACCINE: (Canine):
1 dose-5 x 1 dose-10 doses-100 doses
AVIANIZED RABIES VACCINE (Cattle): 10 doses
AVIANIZED CANINE DISTEMPER VACCINE:
1 dose-10 x 1 dose
ANTI-CANINE DISTEMPER SERUM AND
ANTI-INFECTIOUS CANINE HEPATITIS SERUM: 100 cc.
INFECTIOUS CANINE HEPATITIS VACCINE:
2 cc.-10 cc.
BRUCELLA ABORTUS VACCINE: 1 dose-5 x 1 dose-
5 doses (25 cc.)
FELINE DISTEMPER VACCINE: 1 immunization
(2 vials Vaccine, 2 vials Sterile Diluent, 2 cc.)
ANTI-FELINE DISTEMPER SERUM: 10 cc.
CARICIDE® Diethylcarbamazine TABLETS:
400 mg., 25's
DIETHYLSTILBESTROL SOLUTION: 10 cc.-50 cc.
LEPTOSPIRA CANICOLA-ICTEROHEMORRHAGIAE
BACTERIN
Whole Cultured Inactivated:
1 dose (4 cc.)
Other products to be added.

BARD-PARKER
presents a *New* concentrate
HALIMIDE



...A COMPLIMENT TO ANY INSTRUMENT

BARD-PARKER presents HALIMIDE, a *new* concentrate of low surface tension and excellent penetrating qualities, scientifically perfected for *inexpensive* instrument disinfection.

HALIMIDE is . . .
RAPIDLY BACTERICIDAL
NON-SELECTIVE
TUBERCULOCIDAL WHEN DILUTED WITH ALCOHOL

- **NON-CORROSIVE**
  NO ANTI-RUST TABLETS TO ADD
- **STABLE**
  NEED NOT BE CHANGED FREQUENTLY
- ***INEXPENSIVE***
  1 ounce makes 1 gal. of solution

LIST PRICE—4 oz. bottle..... $2.50
Please see your Dealer for quantity discounts

PARKER, WHITE & HEYL, INC.
Danbury Connecticut

HALIMIDE and your INSTRUMENTS
...THEY COMPLIMENT EACH OTHER

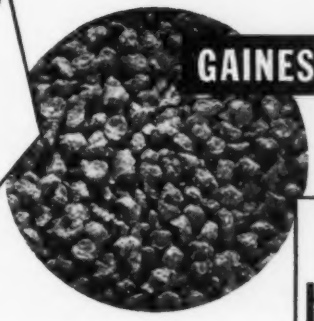
Dog Food Used to Breed Worms, Feed Minnows and Raise Birds

Paul Q. Tulenko, of the Missouri Conservation Commission, breeds his own English Red Wrigglers for fishing by taking one or more ten-quart galvanized pails, perforating the bottom and lower sides of each with tiny holes for drainage, and filling each loosely with garden dirt that is not sandy. The dirt is then thoroughly mixed with a cup of Gaines homogenized dog meal. Next, the mixture is sprinkled over with a pint to a quart of water per pail, making it moist but not muddy. Twenty-five to 50 adult English Red Worms are now dropped on top of the soil in each pail and the pail or pails placed in a cool part of the basement away from the furnace and where the temperatures will average 60 to 70 F. The pails are checked once a week to see if they require watering, but over-watering is to be avoided. Once every three weeks the top two or three inches of dirt is removed and one-half cup of dog food mixed with it. The remaining dirt is dumped out of the pail, the newly-fed soil put on the bottom, and the rest of the dirt replaced. According to Mr. Tulenko, this culture will yield a new crop of young worms in from six to eight weeks, and in about 12 weeks they will be large enough for bait. One active culture pail may have as many as 700 to 1000 fishing-size worms in it plus an indefinite number of baby worms. Two pails will supply more worms than the average family of fishermen can use. The culture can be started any time during the calender year, and the limit of worms raised is governed only by the number of pails used.

Harold P. McGrath, of Kankakee, Ill., whose firm makes the Gaines homogenized dog food, uses it with success for feeding minnows brought along for fishing. He sprinkles the granules on top of the water in which he keeps his minnows. The minnows so fed are much livelier, there is very little loss even during long periods of time, and they seem to do a better job of enticing fish, he states.

Mrs. O. C. Swanson, Salisbury, N. C., has found Gaines canned dog food exceptionally good for birds. Her parakeets love it, and their plumage has improved greatly. She also reports that she has been able to save the life of a wild bird by feeding it nothing but this prepared dog food.

the big difference here...



GAINES MEAL

makes a big difference here...

Yes, Gaines makes the difference

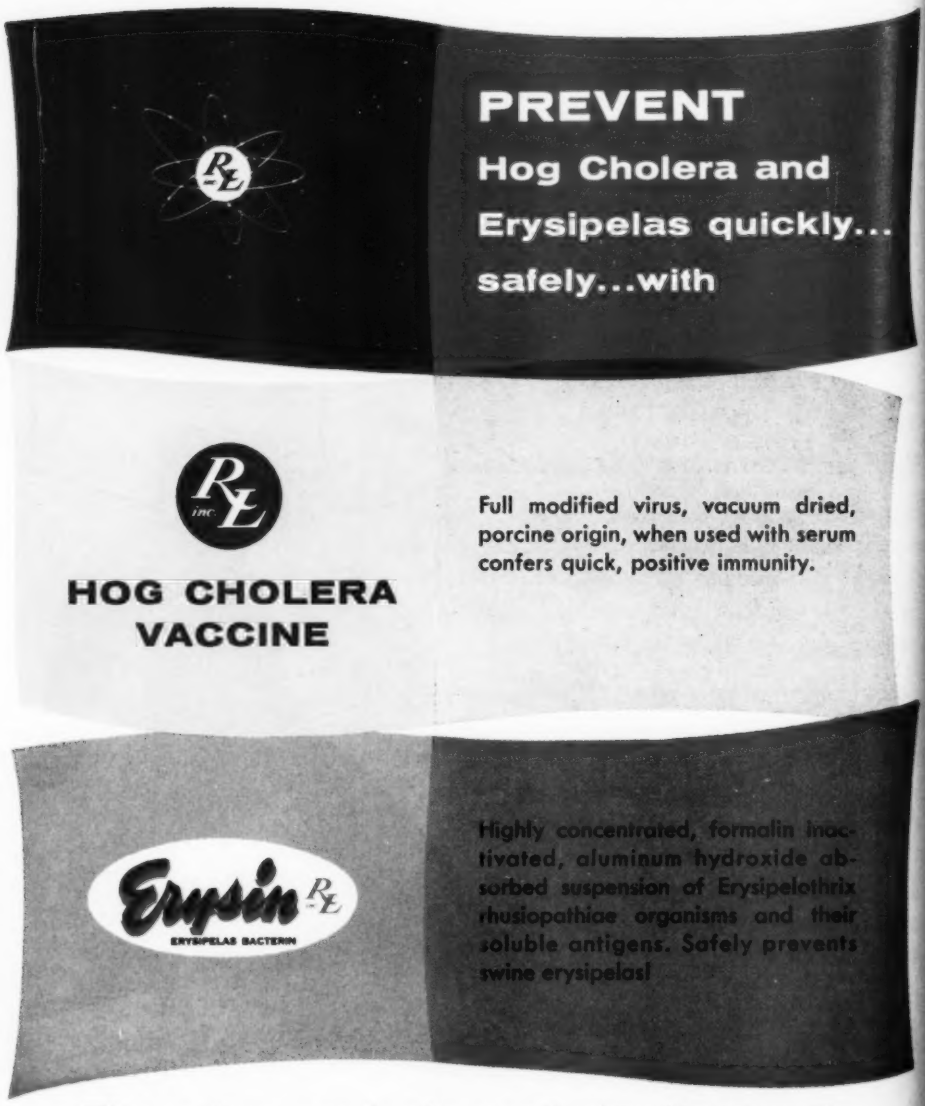
because the special Gaines homogenizing process combines ingredients of the Gaines formula into appetizing granules—each granule containing uniform amounts of every food element dogs are known to need.

Gaines program of quality control, testing and research is an exacting and never-ending one. It results in what we honestly believe is the highest standard possible in the production of dog food. Gaines Homogenized Meal is far more assimilable, more palatable and much easier to feed . . . good reasons why Gaines is America's largest-selling dog meal.

Gaines indeed makes the difference . . . you can use Gaines with confidence . . . recommend Gaines with confidence . . . because complete and uniform nourishment is guaranteed.

A Product of General Foods

Gaines ***HOMOGENIZED*** **DOG MEAL**


PREVENT
Hog Cholera and
Erysipelas quickly...
safely...with
HOG CHOLERA
VACCINE
Full modified virus, vacuum dried, porcine origin, when used with serum confers quick, positive immunity.
Erysin
ERYSIPELAS BACTERIN
Highly concentrated, formalin inactivated, aluminum hydroxide absorbed suspension of Erysipelothrix rhusiopathiae organisms and their soluble antigens. Safely prevents swine erysipelas!

These two products used simultaneously offer safety, efficiency and reliability in the prevention of Hog Cholera and Swine Erysipelas.

Sales to graduate veterinarians through Independent Ethical Distributors.

RESEARCH LABORATORIES, INC., Saint Joseph, Missouri

Shuttleworth Division of Pitman-Moore Company

Pitman-Moore Company's parent firm, Allied Laboratories, Inc., announced it has acquired E. B. Shuttleworth, Ltd., Toronto, Canada, which, for 77 years has manufactured and distributed human pharmaceutical products throughout the Canadian provinces. The Canadian firm will become a division of Pitman-Moore Company.

The Shuttleworth Company, founded in 1879, in addition to its own line, will manufacture and distribute Pitman-Moore human pharmaceutical products. Since the Canadian firm does not engage in the biological field, it will distribute Pitman-Moore human vaccines and other such products.

Allied Laboratories, Inc., has marketed its veterinary pharmaceutical and biological products in Canada since 1947 through a wholly owned subsidiary, Pitman Moore Company of Canada, Ltd., at Guelph, Ontario, but the acquisition of the Shuttleworth firm marks its entry into the Canadian market with its human preparations. Pitman-Moore Company of Canada, Ltd., will continue to be its sole Canadian distributor of products for use in the veterinary field.

John L. McKee, president of Allied Laboratories, Inc., said that the Shuttleworth manufacturing facilities will be expanded in the near future, but the name, policies, and personnel will remain unchanged. However, the Canadian firm now will draw upon the extensive research facilities of Pitman-Moore Company.

The transaction, which involves the sale of the Shuttleworth stock to Allied, is expected to be completed January 31, 1957.

SPECIAL
DAIRMOL DUSTING POWDER
FOR GRANULAR VAGINITIS

Antiseptic **Astringent**

"THE DAIRMOL WAY"

Compounded under the direction of veterinarians of exceptional experience. Highly recommended by leading herdsmen as the best treatment for the purpose.
Also mfrs. of LIQUID Dairmol Antiseptic and Deodorant.

DALARE ASSOCIATES
23rd and Locust Sts. PHILADELPHIA 3, PA.

Calciphos - *organic calcium - phosphorus compound*
TRADE MARK

From the Heart of Corn

Easily Assimilable Calcium

Protects against depletion of Mineral Reserves - Pregnancy - Lactation - Weaning - Anorexia

Helps Correct Mineral Deficiencies - Rickets - Skin Diseases - Nervous Disorders - Slow Union of Fractures

Daily Dose of Calciphos: For small animals 2 to 4 tablets, or 1 or 2 teaspoonfuls powder, mixed with food.

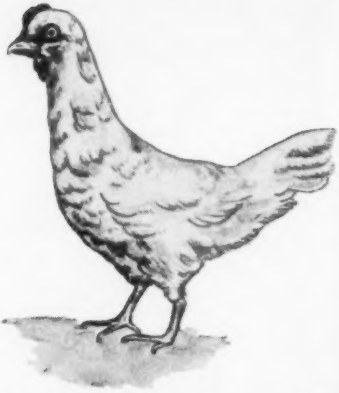
Calciphos: 10-grain tablets in bottles of 100 and 500. Powder in bottles of 5 oz.

WRITE FOR LITERATURE AND SAMPLE

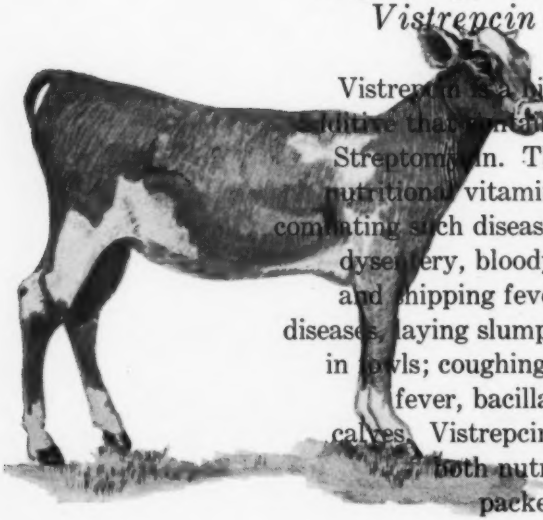
Calciphos, Reg. U. S. Pat. Off., E. Bilhuber, Inc., Mfr.

BILHUBER-KNOLL CORP. ORANGE, NEW JERSEY

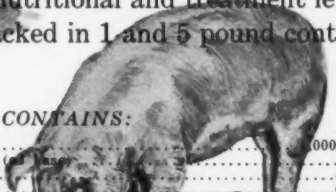
the simplest method



. . . for effectively fighting disease in poultry, calves, and swine is to add Vistrepcin to their drinking water.



Vistrepcin is a highly dispersible drinking water additive that contains both Procaine Penicillin and Streptomycin. These two antibiotics along with nutritional vitamins B_{12}, A and D_3 are helpful in combating such diseases as necro black scours, vibrio dysentery, bloody diarrhea, bacillary infections, and shipping fever in swine; chronic respiratory diseases, laying slumps, blue comb and weight losses in fowls; coughing, calf scours, pleurisy, shipping fever, bacillary dysentery and bronchitis in calves. Vistrepcin, a fast-acting product used at both nutritional and treatment levels, is packed in 1 and 5 pound containers.



EACH POUND CONTAINS:

Procaine Penicillin G	000,000 Units
Streptomycin Sulfate (as base)	3.0 Gms.
Riboflavin	400.0 mgs.
Calcium pantothenate	600.0 mgs.
Niacin	1400.0 mgs.
Vitamin B_{12} Activity	000.0 mcgs.
Vitamin A (palmitate oil)	U.S.P. Units
Vitamin D_3	I.S. Units
(In an inert base)	

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MEETING CALENDAR

Michigan State University. Thirty-fourth annual Post Graduate Conference for Veterinarians. College of Veterinary Medicine, Michigan State University, East Lansing, Mich., Jan. 22-23, 1957, C. F. Clark, dean.

Iowa Veterinary Medical Association. Annual Meeting. Hotel Fort Des Moines, Des Moines, Iowa, January 22-24, 1957. F. B. Young, Waukee, Iowa, secretary.

North Carolina Veterinary Conference. Nineteenth Annual Meeting. North Carolina State College, Raleigh, N. C., Jan. 22-25, 1957. C. D. Grinnells, State College, Raleigh, N. C., chairman, Conference Committee.

Maryland State Veterinary Medical Association. Winter Meeting. Lord Baltimore Hotel, Baltimore, Md., Jan. 23-24, 1957. John D. Gadd, Cockeysville, Md., secretary-treasurer.

Virginia Veterinary Medical Association. Annual meeting. Hotel John Marshall, Richmond, Va., Jan. 27-29, 1957. W. B. Bell, 1303 Hillcrest Drive, Blacksburg, Va., secretary-treasurer.

California State Veterinary Medical Association. Midwinter Conference. School of Veterinary Medicine, University of California, Davis, January 28-30, 1957. Charles S. Travers, 3004 16th Street, San Francisco, Calif., executive secretary.

Minnesota State Veterinary Medical Society. Annual Meeting. Radisson Hotel, Minneapolis, Minn., February 4-6, 1957. B. S. Pomeroy, Minnesota School of Veterinary Medicine, St. Paul 1, Minn., secretary-treasurer.

Kansas Veterinary Medical Association. Annual Meeting. Lamer Hotel, Salina, Kans., Feb. 6-8, 1957. Dr. K. M. Curts, 70 Central Ave., Kansas City, Kans., secretary.

New Jersey Veterinary Medical Association. Annual meeting. Hotel Berkley-Cartarett, Asbury Park, N. J., Feb. 13-14, 1957. Dr. David A. Meirs, Route 9, Freehold, N. J.

Missouri Veterinary Medical Association. Convention. Chase Hotel, St. Louis, Mo., Feb. 15-16. Sales Barns Inspector's Meeting, Feb. 17. Dr. Paul L. Spencer, P.O. Box 283, Jefferson City, Mo., secretary.

Colorado A & M College, Eighteenth Annual Veterinary Conference. Colorado A & M Veterinary Hospital, Fort Collins, Colo., Feb. 18-20, 1957. Dr. O. R. Adams, Colorado A & M College, Fort Collins, Colo.

Illinois State Veterinary Medical Association. Seventy-fifth Annual Convention. LaSalle Hotel, Chicago, Ill., Feb. 25-27, 1957. C. B. Hostetler, 1385 Whitcomb Ave., Des Plaines, Ill., executive secretary.

Alabama Veterinary Medical Association. Meeting, Lyons Hotel, Decatur, Ala., March 17-19, 1957. M. K. Heath, secretary.

American Animal Hospital Association. Annual Meeting. Palace Hotel, San Francisco, Calif., May 8-11, 1957. W. H. Riser, 5335 Touhy Ave., Skokie, Ill., executive secretary.

Kansas State College. Nineteenth Annual Conference for Veterinarians. School of Veterinary Medicine, Manhattan, Kans., May 26-28, 1957. E. E. Leasure, dean.

School of Veterinary Medicine, Texas A. & M. College. Tenth Annual Texas Conference for Veterinarians. College Station, Texas, June 6-7, 1957. R. D. Turk, conference chairman.

Maryland State Veterinary Medical Association. Summer Meeting. George Washington Hotel, Ocean City, Md., June 27-28. John D. Gadd, Cockeysville, Md., secretary-treasurer.

▼ ▼ ▼

DEATHS OF VETERINARIANS

James A. Campbell, Toronto, Ont., ONT '00, Oct. 25, 1956.

George W. Grim, Merion, Pa., UP '16, October 1956.

E. M. Aldrich, Belmont, Mass., UP '13, Nov. 8, 1956.

R. M. Allen, Marshalltown, Iowa, CVC '03, Aug. 24, 1956.

J. G. Badenheimer, Freebuin, Ky., ONT '14, July 2, 1956.

Leslie H. Baker, Fort Worth, Texas, KCV '14, Aug. 31, 1956.

Walter C. Bateman, San Bernardino, Calif., IND '13, Sept. 25, 1956.

Marvin L. Biggs, Pocatello, Idaho, COL '55, Oct. 1, 1956.

Wilmer B. Billingsley, Towson, Md., USC '11, Oct. 9, 1956.

Wallace L. Derrer, Mt. Carroll, Ill., CHI '20, Sept. 25, 1956.

Charles W. Fogle, Leipsic, Ohio, ONT '07, Sept. 27, 1956.

Clinton L. Goodwin, Pikesville, Md., USC '11, Oct. 1956.

in ketosis

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1945

"This continues to be an important problem to the veterinarian in dairy cattle practice. Some years ago, it appeared to be primarily a disturbance of such a nature that the body was unable to metabolize the fats—more carbohydrate was needed, more ready energy. Many cases responded to glucose intravenously, supported by the feeding of cane molasses or corn syrup. Others responded when chloral hydrate was administered, its effects being to liberate the glycogen stored in the liver.

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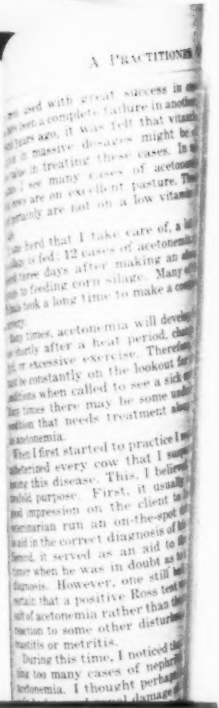
"So the search for the underlying cause, and for a means of preventing or correcting the condition, still goes on."

Report of the Committee on Diseases of Dairy Cattle, R. C. Klussendorf, Chairman, J.A.V.M.A. *107*:355 (Nov.) 1945.



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Link, R. P.; Newton, D. L., and Huber, W. G.: Paper presented at 93rd Annual Meeting, A.V.M.A., Oct. 15-18, 1956, San Antonio, Texas.

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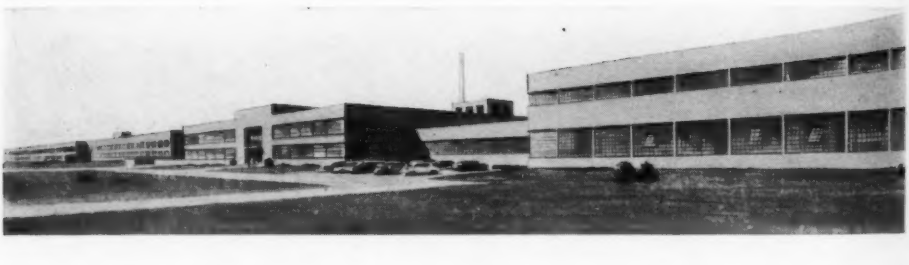

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—DEATHS OF VETERINARIANS—

George W. Higginson, Ottawa, Ont., ONT '98, July 16, 1956.

Harry D. Hooge, Bloomington, Ind., CIN '18, Sept. 22, 1956.

John A. Jaeger, West Concord, Minn., MCK '16, May 16, 1956.

Henry F. Kirby, Belgrave, Ont., '06, died recently.

Fred C. Krowl, Elmira, N. Y., Aug. 10, 1956.

J. D. McGregor, Butte, Mont., ONT '89, Aug. 30, 1956.

Earl G. Morningstar, St. Paris, Ohio, CIN '15, Sept. 26, 1957.

Roy E. Patterson, Memphis, Tenn., ISC '23, July 1956.

Ralph W. Schlenker, Celina, Ohio, KCV '10, Aug. 21, 1956.

A. W. Sutherland, Andes, N. Y., OVC '80, Aug. 4, 1956.

Virgil W. Wooden, Eau Claire, Wis., COL '21, Sept. 26, 1956.

▼ ▼ ▼

Death Erroneously Reported

The January 1957 issue of VETERINARY MEDICINE reported the death of Dr. V. V. Martinson, Wauwatosa, Wis. This was in error, and we are pleased to report that the latest information on Dr. Martinson indicates he is in good health.

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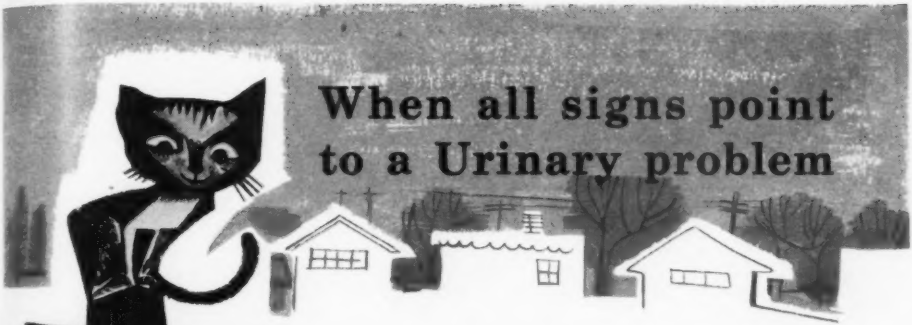

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